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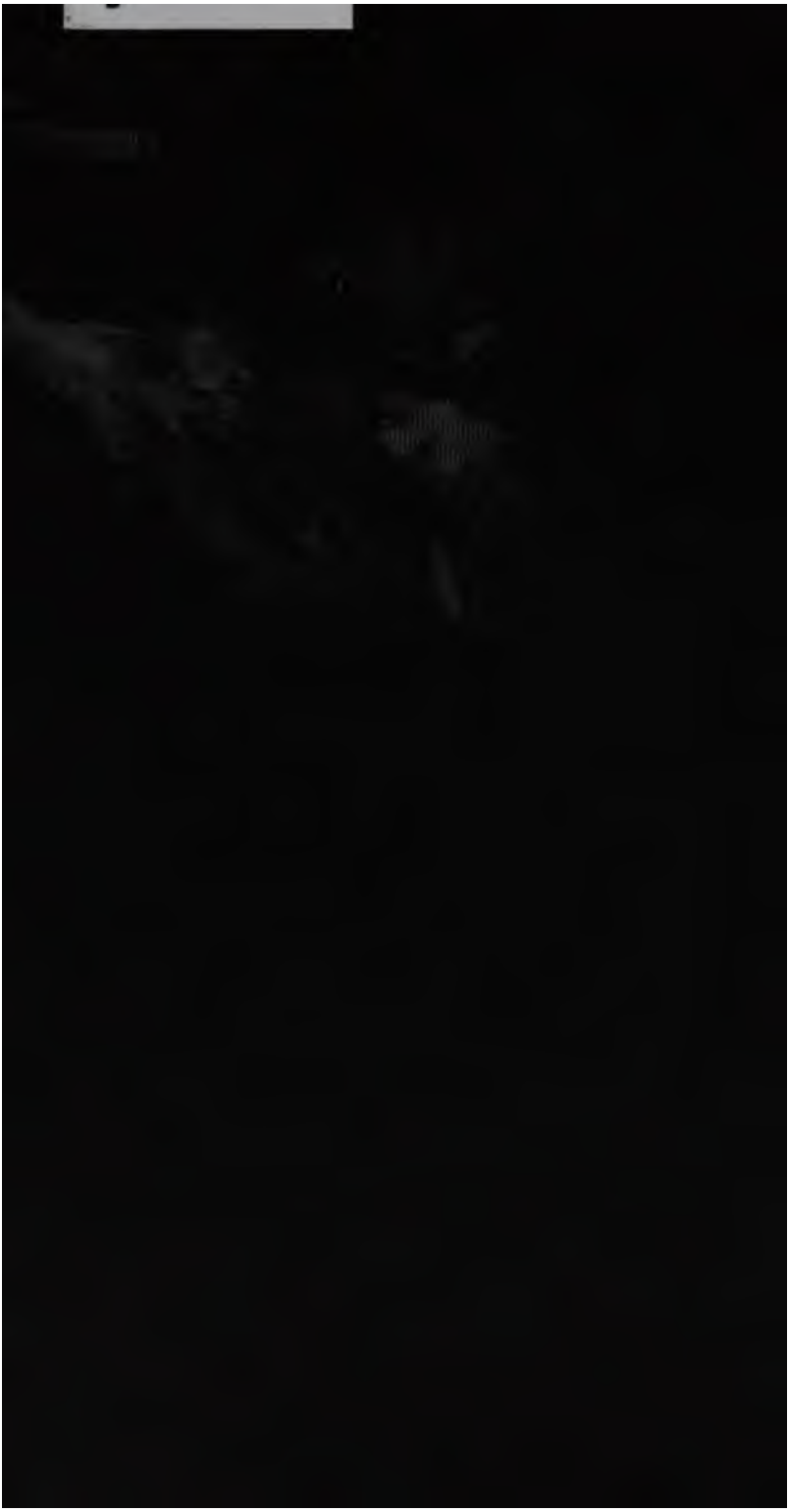

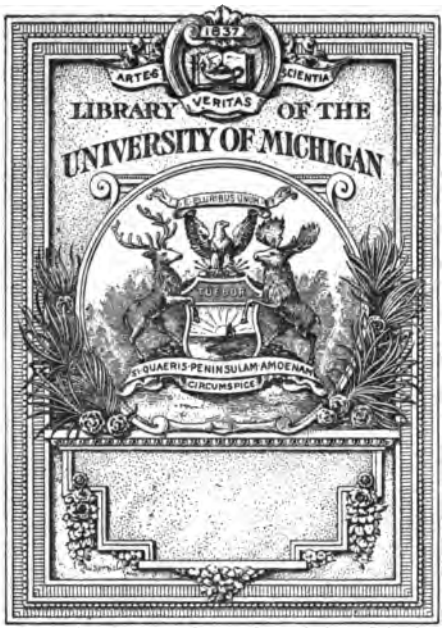


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THE

# UNIVERSITY STUDIES

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# INDEX

Electric Double-Refraction in Carbon Disulphide
*Gustaf W. Elmén* ..... 1

English Version of Oehlenschläger's Hakon Jarl
*James Christian Lindberg* ..... 39

Newly-Discovered Shakespeare Documents
*Charles William Wallace* ..... 347

On the Conflict of Parties in the Jacobin Club
*Charles Kuhlmann* ..... 229

On the Crises of 1837, 1847, and 1857
*Ira Ryner* ..... 143

On the Movements of Petals
*Esther Pearl Hensel* ..... 191

On the Substantivation of Adjectives in Chaucer
*Arthur Garfield Kennedy* ..... 251

Plant Migration Studies
*Charles E. Bessey* ..... 11

State Control and Supervision of Charities and Corrections
*Anderson William Clark* ..... 357

Studies on Human Parasites in North America—I. *Filaria loa*
*Henry B. Ward* ..... 271

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# UNIVERSITY STUDIES

VOL. V *JANUARY 1905* No. 1


## I.—*Electric Double-Refraction in Carbon Disulphide at Low Potentials*


BY GUSTAF W. ELMÉN


When light polarized at an angle of forty-five degrees to the lines of force is passed through certain dielectrics, between two parallel electrodes, they become double-refracting. The difference of phase, $\delta$, between the two components of light at right angles and parallel to the lines of force, as represented by Kerr and verified by later investigators, is

$$\delta = \pm \frac{BP^2 l}{a^2} \tag{1}$$

where $B$ is the electro-optic constant, depending on the dielectric, $l$ the length, and $a$ the distance between the plate electrodes in centimeters, and $P$ the difference of potential between the electrodes in C.G.S. units.

From data obtained in this investigation, there seems to be a decided variation from the above law for low potentials. As the potential was decreased from about 200 volts per millimeter of distance between the electrodes, the decrease of $\delta$ was in a smaller ratio than the decrease of $P^2$.

In determining the electro-optic constant, either a high potential or a sensitive system of measuring $\delta$ must be used. In the


UNIVERSITY STUDIES, Vol. V, No. 1, January 1905.

investigations of Kerr,[1] Quincke,[2] Lemoine,[3] and Schmidt,[4] high potentials were employed. The difference of phase was measured by means of a Babinet's compensator, and the potential, supplied either by a static machine or an induction coil, by means of an electrometer. The difference in the values of $B$ obtained by different observers and also of the values obtained by the same observer, as in the case of $CS_2$, where the values of Quincke vary by one part in five, Schmidt points out as probably due to the difficulty in measuring high potentials with a sufficient degree of accuracy. To eliminate this error he used two sets of electrodes on the same axis of rotation as the beam of light and set at right angles, so that the effect of one set was compensated by that of the other. This, however, gives only relative values, and some other method must be depended upon for absolute measurements.

A sensitive system of determining the difference of phase has been used in this investigation. In place of the Babinet's compensator, an elliptic half-shade polarizing system[5] was employed. With this system, as used in this particular problem, values of $\delta$ equal to $.0001\lambda$ could be observed. In measurements taken the lowest value recorded is $.00025\lambda$. This brought the potential that could be used down to less than 100 volts per millimeter of distance between electrodes of 47 cm. length. For $CS_2$ with the same length of electrodes the smallest value recorded by Quincke is over 3,000 volts per millimeter of distance. The potential was supplied by a storage battery of about 1,400 volts, and as the smallest potential used was less than 200 volts, a range of seven times this voltage was at the writer's disposal. The potential was measured by means of a voltmeter which had been calibrated so that the possible errors for the lowest potentials were less than 1 per cent.

The half shade system consisted of two thin mica sections. One, the "sensitive strip" $S$ (fig. 1), placed next to the polarizing

[1] J. G. Kerr, *Phil. Mag.* (4), 50, p. 446, 1875; (5), 8, pp. 85 and 229, 1879; (5), 9, p. 157, 1880, and (5), 13, pp. 153 and 248, 1882.

[2] G. Quincke, *Wied. Ann.*, 10, p. 729, 1883.

[3] J. Lemoine, *Compt. Rend.*, 122, p. 835, 1896.

[4] W. Schmidt, *Ann. d. Physik.*, 7, p. 142, 1902.

[5] D. B. Brace, *Phys. Rev.*, vol. 18, p. 70, vol. 19, p. 218, 1904.

Nicol $N$, covered half of the field and was placed with its principal axis at an aximuth of forty-five degrees to the plane of vibration of the polarized light. The edge of this strip was parallel to the faces of the electrodes, thus making the vanishing line parallel to the greatest dimension of the field of view. When electrodes of greatest length (127 cm.) were used, this strip was placed between the compensator and the analyzer, as the distance was too long to give good definition. The second section, the "compensator" $C$ (fig. 1), was placed next to the analyzing Nicol $N'$, and covered the whole field. This section was mounted on a circle with a vernier that could be read to minutes. The position of the strip was changed several times, so that readings were obtained from different parts of the circle and thus eliminated any possible instrumental errors.

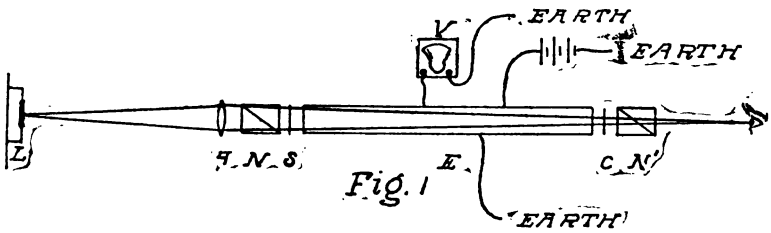


Fig. 1

A forty-eight candle power Nernst "glower," one centimeter long and one millimeter in diameter, was first used as light-source $L$ (fig. 1). Later, observations were taken with sunlight passed through a spectroscope and observations were taken for red (620 $\mu\mu$), green (540 $\mu\mu$), and blue (490 $\mu\mu$) light. By means of a condensing lens $A$ (fig. 1) the light was passed through the polarizing Nicol, the "sensitive strip," the liquid between the plate electrodes $E$ (fig. 1), through the compensator, analyzer, and thence to a focus $O$ within the observer's eye. When sunlight was used the light was strong enough to allow the use of a short focus telescope with small magnifying power placed next to the analyzer. One of the electrodes was grounded and the other connected to the storage battery. $V$ is a voltmeter, connected across the electrodes.

A thermometer was placed in the liquid and read before and after observations were taken. The measurements were taken at room temperature.

The order of the compensator was found by comparing it with a quarter-wave plate. The compensator was set for a match, and the quarter-wave plate placed in the field so that it produced no effect. The compensator was now rotated through an angle of five or ten degrees and the quarter-wave plate rotated until the intensities of the two halves of the field were again the same. Then,[1] if $N'$, $\theta'$ and $N$, $\theta$ are the orders and the degrees respectively through which the two plates are rotated

$$N'\theta = N\theta'$$

(4) or $$N = \frac{N'\theta}{\theta'}.$$

Having thus found the order of the "compensator" for a certain wave-length, its order for any other wave-length was found by means of the curve of differential dispersion of mica.[2]

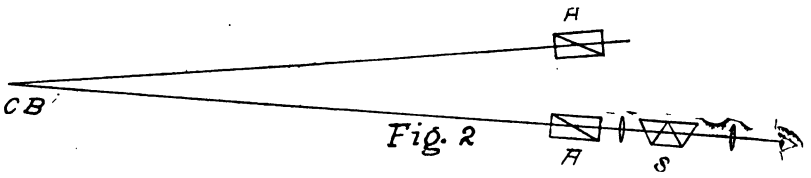



Fig. 2

The wave-length for which the quarter-wave plate produced a retardation of $\lambda/4$ was determined in the following manner: A beam of sunlight polarized at forty-five degrees to the principal axis of the plate was passed twice through the plate and then through a second Nicol with its plane parallel to the polarizer. The beam was analyzed by means of a spectroscope. The spectrum contained a black band corresponding to a retardation of half a wave-length. The plate used was found to correspond to

[1] D. B. Brace, *Phys. Rev.*, vol. 18, p. 73, 1904.
[2] E. J. Rendtorff, *Phil. Mag.*, May, 1901, p. 545.

$\lambda = 560\ \mu\mu$. In fig. 2, $A$ and $A'$ are the two Nicols, $B$ the quarter-wave plate, $C$ a mirror silvered on the first surface, and $S$ the spectroscope.

In taking observations, "the compensator" was set for a match, and then the plate electrodes charged and the "compensator" rotated until a match was again obtained. Then if $\theta$ is the angle through which the "compensator" was turned, $N$ the order of the "compensator"

$$\delta = \frac{4N\theta}{180} = \frac{N\theta}{45} \text{ when } \theta \text{ is small} \qquad (2)$$

and from (1)

$$\frac{N\theta}{45} = \pm\frac{BP^2l}{a^2} \qquad (3)$$

For the same potential the settings of the mica "compensator" were approximately the same for all the colors used, showing that for the small differences of phase produced, the electric differential double refraction of $CS_2$ is approximately the same as the differential double refraction of mica.

Two lengths of plate electrodes were used. The first made of nickel-plated brass strips 47 cm. long and 1.5 cm. wide. They were connected to the wires leading to the ground and the battery by two rods, screwed into the plates, and taken out through glass tubes 5 cm. long, welded on the sides of the containing tube. Small glass strips were placed between them at the edges at intervals and held in position by fish glue. The electrodes were placed in a tube 2.5 cm. in diameter and extended 1 cm. from each end. On the ends of the tube were fastened squares of glass in which holes 1 cm. in diameter had been bored, and then covered with thin cover-glasses. These cover-glasses were tested for double-refraction after they were glued on, for it happened in several cases that the drying of the glue produced enough strain in the glass to be observed.

It was found quite difficult to obtain perfectly parallel metal strips for the longer electrodes, viz., 127 cm., so that plate glass strips were used instead. A thick coating of silver was deposited on one side of each plate, and the silvering carried over at the

opposite ends, where contact was made by a couple of brass clamps which also served to hold the plates in position. Copper wires were soldered to these clamps and taken out through holes bored in the end plates of the tube. The electrodes were separated in the same way as before. They rested without support in the tube containing the liquid. Fig. 3 shows a vertical and an end view of the electrodes. The formation of $A_2S$ when the electrodes were in contact with $CS_2$ was slow, and they could be used for some time without resilvering.

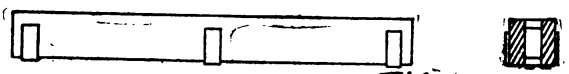
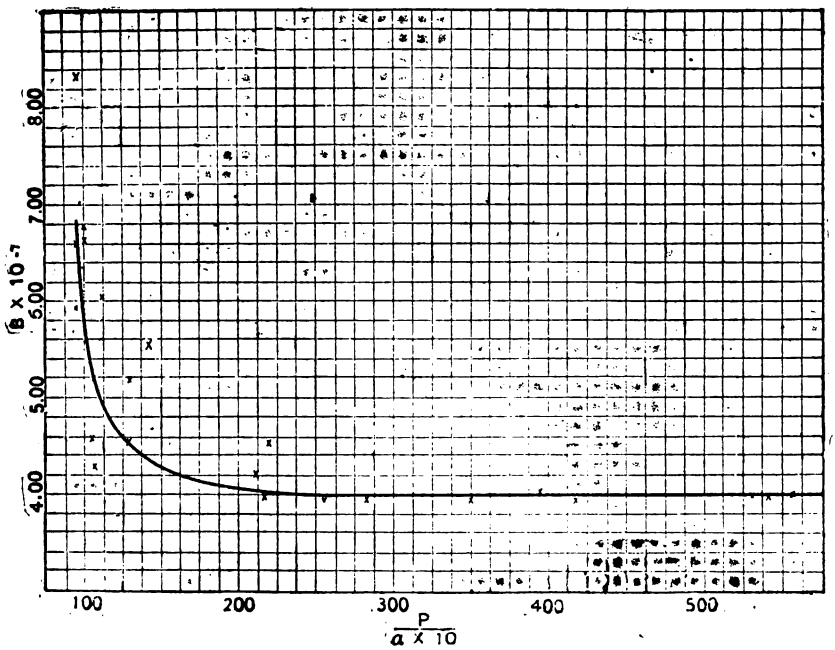


Fig. 3

The liquid used was $CS_2$. The ordinary commercial $CS_2$ was found to have a great number of small particles in it which would vibrate between the electrodes when the charge was put on, so that it was found very difficult to maintain a high difference of potential between them. It was therefore found necessary to clarify the liquid by filtering it through a porous cup which was fastened into the neck of a glass flask by means of plaster of Paris. Immediately below the neck was a hole in the flask into which a glass tube was cemented. This tube was connected to a vacuum pump, and thus the liquid was forced through the porous cup. The filtering of the $CS_2$ did not, however, seem to appreciably change the electro-optic constant of the liquid. Table I gives the manner in which each recorded value of $B$ in the following tables was obtained. For voltages below 200 volts per millimeter distance between electrodes, each value of $B$ is the mean of twenty observations instead of nine. Tables II and III give mean values obtained with the brass electrodes with $a$=.2545 cm. and $a$=.184 cm. Table IV gives values obtained with the silvered electrodes. The values between the three sets agree fairly well. Table V gives values obtained for different colors. For the same value of $P$ for different wave-lengths, $\theta$ remains approximately the same, and in calculating the value of $B$ it was only necessary to multiply the value of $B$, obtained from

equation (3), by the ratio of the order of the "compensator" $\left[N=\frac{1}{43.8}\right]$ determined by means of the quarter-wave plate for that particular value of $\lambda$, which, in this case, was 560 $\mu\mu$, while the order for any other colors used was obtained by interpolating from the curve obtained by Rendtorff.




In fig. 4 the values of $B\times 10^{-7}$ are plotted as ordinates and $\frac{P}{a\times 10}$ as abscissae. The curve is approximately a straight line until about 200 volts per millimeter of distance, when it turns and seems to become almost asymptotic to the ordinates. On obtaining these low values the errors of observation were of course large, owing to the smallness of the effect, and at first it was thought that the large deviation from the law was due to some systematic error. To eliminate such possible errors, the apparatus was taken down and remounted under different con-

ditions. This, however, did not give any difference in values obtained for $B$.[1]

There is a great similarity between $B$, the constant of electric polarization in $CS_2$, as determined by means of double-refraction, and $\mu$, the permeability, as determined by means of magnetic induction, and this suggests that possibly the double-refraction in liquids under electric strain is due to a state of polarization analogous in nature to that which takes place in a magnetic substance when in a state of polarization.

TABLE I

$l$=47 cm. $a$=.2545 cm.

| TEMP. | VOLTS | READ. OF COMP. WITH POT. ON. | READ OF COMP. WITH POT. OFF. | $B\times10^{-7}$ |
|---|---|---|---|---|
| 19°C | 1360 | 354°17′ | 6°13′ | |
| | | 354°38′ | 6°18′ | |
| | | 354°15′ | 6° 5′ | |
| | | 354°32′ | 6°16′ | |
| | | 354°16′ | 6° | |
| | | 354°19′ | 5°54′ | |
| | | 354°15′ | 5°58′ | |
| 20°C | | 354°17′ | 5°51′ | |
| | | 354°24′ | 6° 6′ | |
| | Mean..... | 354°22.5′ | 6° 4.5′ | |
| Rotation = 11°42′ | | | | 4.05 |

[1] It might be suggested that the readings of the voltmeter do not give the true drop in potential within the liquid owing to a possible polarization at the electrodes, analogous to that within electrolytes, which, at the low potentials used, might make itself evident. This could be determined by varying the distance of the electrodes and comparing the observations for the same drop of potential. This conclusion does not seem to be borne out by the data in tables 2 and 3 where $a$=.2545 cm. and .184 cm. respectively.

TABLE II

$l$=47 cm. $\lambda$=560 $\mu\mu$ $a$=.2545 cm.

| TEMP. | VOLTS | 0° | $B\times10^{-7}$ |
|---|---|---|---|
| 23.5°C | 1389 | 11.66° | 3.88 |
| 19.5° | 1360 | 11.68° | 4.05 |
| 18.5° | 1345 | 11.6° | 4.11 |
| 20° | 1043 | 6.77° | 3.94 |
| 19° | 995 | 6.28° | 4.07 |
| 20° | 880 | 4.74° | 3.94 |
| 21° | 720 | 3.16° | 3.92 |
| 22° | 649 | 2.58° | 3.93 |
| 19° | 556 | 2.16° | 4.53 |
| 22° | 531 | 1.8° | 4.09 |
| 20° | 357 | 1.1° | 5.53 |
| 19° | 324 | .74° | 4.52 |
| 20° | 324 | .84° | 5.13 |
| 19.5° | 283 | .76° | 6.04 |
| 24° | 252 | .65° | 6.77 |
| 22° | 252 | .68° | 6.56 |
| 22° | 247 | .62° | 6.51 |
| 19.5° | 244 | .77° | 8.29 |
| 19° | 243 | .53° | 5.88 |

TABLE III

$l$=47 cm. $\lambda$=560 $\mu\mu$ $a$=.184 cm.

| TEMP. | VOLTS | 0° | $B\times10^{-7}$ |
|---|---|---|---|
| 23°C | 876 | 8.7° | 3.78 |
| 25° | 861 | 8.24° | 3.71 |
| 23° | 418 | 2° | 3.82 |
| 25° | 242 | .74° | 4.22 |
| 23° | 193 | .58° | 5.19 |
| 25° | 191 | .53° | 4.56 |
| 25° | 191 | .46° | 4.23 |

TABLE IV

$l$=127 cm. $\lambda$=560 $\mu\mu$ $a$=.656 cm.

| TEMP. | VOLTS | 0° | $B\times10^{-7}$ |
|---|---|---|---|
| 19°C | 1364 | 4.84° | 4.08 |
| 20° | 1355 | 4.88° | 4.17 |
| 20° | 1334 | 4.38° | 3.85 |
| 20.5° | 1328 | 4.27° | 3.84 |
| 18° | 1314 | 4.53° | 4.11 |
| 20° | 1017 | 2.8° | 4.25 |
| 20° | 1017 | 2.87° | 4.35 |
| 19.5° | 1040 | 2.9° | 4.17 |

TABLE V

$l$=47 cm. $a$=.184 cm.

| $\lambda$ in $\mu\mu$ | TEMPERATURE | VOLTS | 0° | $B\times10^{-7}$ |
|---|---|---|---|---|
| 620 | 23° | 807 | 7.6° | 3.00 |
| | 23° | 525 | 3.1° | 2.93 |
| | 23° | 240 | .73° | 3.17 |
| | 23° | 190 | .6° | 4.32 |
| 540 | 23° | 997 | 11.75° | 4.13 |
| | 23° | 841 | 8.5° | 4.16 |
| | 23° | 543 | 3.4° | 4.20 |
| | 23° | 242 | .78° | 4.88 |
| | 23° | 191 | .6° | 5.96 |
| 490 | 23° | 955 | 11.5° | 5.51 |
| | 23° | 670 | 5.38 | 5.64 |
| | 26° | 387 | 1.67 | 5.23 |
| | 26° | 250 | .66° | 5.33 |
| | 26° | 190 | .5° | 6.39 |

## II.—*Plant Migration Studies*

BY CHARLES E. BESSEY

### I. FOREST TREES.

It is a familiar fact that new species appear from time to time among the native plants of a region. Such newcomers turn out on examination to be new only in the sense that they have not previously lived in the region, and in every instance these new plants are found to have come from other regions where they had existed for a longer or shorter period of time. In some cases the new species remain for a time and then disappear, or at least become inconspicuous, but more commonly they crowd in among the former plants and become permanent members of the plant community. Whenever such an addition is made to the flora of a region there is a readjustment of the former species, with a necessary change in the relative numbers of the individuals, and the particular habitat of each. In the case of annual plants these adjustments are made rapidly, so that in a short time the prominent features of the plant community may be entirely changed. On the other hand, in the case of perennial plants there is greater stability, new species finding greater difficulty in entering, and the old species giving away, if at all, only after the lapse of a much longer time. A vegetation which is well rooted in the ground is much less easily disturbed than one whose roots live for but a single season and then abandon the particular plot of ground where they grow. Forests are therefore conservative plant communities, into which new species gain entrance with difficulty, and which change very slowly after such entrance has been effected. There is only one other plant community whose stability approaches that of the forest, namely, the grassy vegetation of the prairies and plains, which is com-

UNIVERSITY STUDIES, Vol. V, No. 1, January 1905.

posed of perennial-rooted grasses, sedges, and rushes. Where these form a close sod new species are almost wholly excluded, and but little change takes place in the character of the vegetation. It is only where the surface is not closely covered that the grassy vegetation is more easily modified by the incoming of new species. Where accident, or disease, or some other cause has destroyed the grassy covering new species promptly take possession. A fine example of this is to be seen in the growth of *Helianthus annuus* on the mounds made on the prairies by such burrowing animals as gophers and prairie dogs. Where the tough sod was broken by the freight-wagons which crossed Nebraska by various "trails" many years ago botanists find many newcomers, which could not have gained a foothold in the unbroken sod.

## FACTORS IN MIGRATION

The means of migration are physical and biological, the former including all the factors which are external to the plant, and which involve the mechanical movement of the plant or some of its parts, while the latter includes the devices on the part of the plant by means of which it takes advantage of physical agencies. In this paper only those means which have to do with the migration of forest trees will be considered, thus limiting the discussion by excluding a multitude of devices of all degrees of complexity which pertain to other plants.

The most general physical agent in the dissemination of plants is the movement of the air in the currents of wind. These sweep over the earth's surface with all degrees of rapidity, and with a carrying power which increases as the squares of the velocities. The fact that winds shift their direction at short intervals, rarely maintaining the same direction for more than a few hours, or at most a few days, makes them especially useful agents in the movement and transportation of such seeds and fruits as can be blown from place to place. It is probably true that to some extent the distribution of all of the species of trees which grow naturally in Nebraska is affected by the winds. The violent and long continued winds of high velocity transport seeds and fruits

of all kinds, whether or not they show any special adaptations for wind carriage.

A second general agent in dissemination is moving water, upon which seeds and fruits may float from place to place. Every brook, every creek, every river carries thousands of seeds, many of which ultimately float to the banks, or are lodged upon sand-bars and islands. In the aggregate the number of seeds carried in this manner is large, but the number of trees resulting from their growth is by no means as great, since many seeds are injured by prolonged soaking in water, and in addition many do not find favorable conditions for growth when cast ashore.

Animals of various kinds are active agents in the dissemination of seeds and fruits, especially of trees. Here the means of transportation are much more efficient, since they may result in the dispersal of seeds in all directions, and often for much greater distances. Squirrels, rats, mice, and other rodents which carry and secrete stores of food, and many herbivorous mammals which feed more or less commonly upon seeds and fruits, are efficient means for distributing the seeds of trees and other plants. To these must be added the birds of nearly all species, excepting those that subsist wholly upon animal food. Their power of swift flight enables them to transport seeds long distances in every direction, across barriers which are practically impassable for quadrupeds. The number of different species which take part in seed dissemination is not less than two hundred in the portion of the central plains included within the boundaries of Nebraska, and of these probably one-third carry the seeds of trees.

Nebraska occupies a central position in the United States, and is somewhat south of the centre of the North American continent. It lies between latitude 40° to 43° north of the equator, and longitude 95°30′ to 104° west of Greenwich. It lies almost wholly in the Great Plains region, or the "Prairie Province" as denominated by Pound and Clements in the "Phytogeography of Nebraska." In the valley of the Missouri River along its eastern border its elevation above sea-level is 268 metres (880 feet) at the southeast, and about 335 metres (1100 feet) at the northeast,

while westward and northwestward the elevation is much greater, reaching 1500 metres (4900 feet) in the northwest, and fully 1616 metres (5300 feet) towards its southwest boundary, near the Wyoming line.

The river system is a very simple one. Along the eastern border is the turbid Missouri River, which receives the Nemaha and Weeping Water (both short streams) south of the mouth of the Platte River. The Platte River flows from the Rocky Mountains as two streams, which unite in western Nebraska, and is, like the Missouri River, a rapid and turbid stream. It receives one tributary, Lodgepole River, in the western part of the state, the much-branched Loup River (which drains the Sandhills) in the centre, and the Elkhorn River toward the northeasterly part. On the north is the Niobrara River which comes from the Wyoming foothills, and in the extreme northwest are branches of the White River, rising in the mountainous country of Pine Ridge. On the south the Republican River comes from the elevated plateau of eastern Colorado, traverses the southern counties, and then passes into Kansas where it joins the Kansas River, and finally reaches the Missouri River. In the southeast, the Blue River drains a triangular area closely adjacent to the Platte River, and flowing south empties into the Kansas River.

The surface features of the state are considerably varied, including the wet and marshy "bottoms" of the Missouri River valley, the steep "bluffs" which limit them on the westerly side, the hilly and broken country still further inland, the rolling surface of the prairies of the eastern portion of the state, the more pronounced hills adjacent to the bluffs of the Platte valley, the broad and nearly level valley of the Platte River, the steep and irregular hills of the Sandhill country, the high plains, "bad lands," buttes, and mountainous ridges of the extreme west.

The soils of Nebraska show much of uniformity. Most of the eastern portion is overlaid with loess, which becomes more sandy westward toward the Sandhills, while still further west it becomes more clayey. These three general types of soil are more or less modified locally, as by the increase of humus in the marshy

borders of some streams, the increase of organic matter in the drainless valleys of the Sandhills, and the alkali soils surrounding many ponds in regions still further west.

The climate of Nebraska is of the "continental" type. The rainfall which reaches 88 centimetres (35 inches) a year in the southeastern part gradually decreases westward to 35 centimetres (14 inches). It is very unequally distributed throughout the year. About 30 per cent falls in the spring, 39 per cent in the summer, 23 per cent in the autumn, and 8 per cent in the winter. The humidity of the air is generally low, and is especially so in the winter. The insolation is high, the days with sunshine being more than three times as many as those without. The temperature ranges are from about 38°C. (100°F.) as the maximum heat of summer, to —36°C. (—30°F.) as the minimum of winter, the former for the southern counties, and the latter for the northern. The prevailing winds are from the southeast in spring and summer, and from the northwest in the autumn and winter. The average for ten years of the number of miles of wind for each season in eastern Nebraska (Lincoln) is, 28,111 in spring, 21,016 in summer, 23,586 in autumn, and 23,460 in winter.

The native trees of Nebraska have developed many devices, for the distribution of their seeds, adapted to the physical factors just described. These may be reduced to five general classes, viz.: wings, hairs, fleshy fruits, rolling balls, edible nuts.

### WINGS

Rock pine (*Pinus scopulorum* (Engelm.) Lemmon). Each seed is provided with a delicate membranous wing, a centimetre long and five to seven millimetres wide. When the seed drops from the cone it is given a whirling motion by a slight twist and bend in the plane of the wing, and if caught by the wind is carried a considerable distance from the parent tree. This tree occurs in the Rocky Mountains from Montana to Wyoming and Colorado, and in Nebraska (1[1]) has pushed out upon the foothills

[1] The figures in parentheses refer to the maps showing the distribution of the different species of trees.

(Pine Ridge, and Wild Cat Mountains), and from these to the bluffs of the Niobrara, and North Platte rivers. From the latter it spread to scattered stations along the eastern edge of the Great Sandhill region (Holt, Greeley, Valley, Custer, Lincoln and Franklin counties).

Basswood or Linden (*Tilia americana* L.). The wing is an extension and enlargement of the bract of the peduncle of the inflorescence. The several spherical, dry fruits at maturity are attached nearly at right angles to this wing, which is slightly bent and twisted. At maturity the bract carrying the fruits separates at its base from the tree, and when caught by the wind whirls horizontally, carrying its freight of seed-bearing fruits often to a distance of many metres from the parent tree. The linden occurs abundantly in the forests bordering the Missouri River southeast of Nebraska, and it now extends up that river along the eastern edge of the state (16) and along the Niobrara River to Cherry County. It has also extended up the valley of the Blue and Republican rivers on the south to Jefferson County, and the Platte River in the central portion of the state, to Nance County.

The Elm (*Ulmus* spp.). The flat seed-pods are winged on their margins so that the surface is increased several times. When ripe they are very light, and are easily carried by the wind to a distance of ten to twenty or more metres from the parent tree. While great numbers fall to the ground under the tree, many are carried to a distance equal to or more than that of the height of the tree.

The White Elm (*Ulmus americana* L.) is very abundant in the valley of the Missouri River southeast of Nebraska, and thence eastward to the Atlantic Ocean. From the southeastern forest body of this species it has extended up the several river valleys into all portions of the state (17) to the western counties.

Rock Elm (*Ulmus racemosa* Thomas) occurs commonly in the forest belt bordering the Missouri River southeastward, and from this region it has moved upward along the eastern border of the state (18) and up the Niobrara River near the northern boundary. While it has been recorded from but two stations (Cass

and Keya Paha counties) it is highly probable that it occurs somewhat sparingly and perhaps intermittently along the eastern and northeastern border.

Red Elm (*Ulmus fulva* Michx.) is abundant in the Missouri River forest area, from which it has spread westward up the river valleys nearly or quite half way across the state (19). Beyond this area a single station is reported in Frontier County.

The Ashes (*Fraxinus* spp.). Each cylindrical seed pod is prolonged upward into a flat oar-shaped, slightly bent and twisted wing. Where the fruit separates from its pedicel it drops with the heavier seed-end down, and is given a whirling motion by the wing, and when caught by the wind is carried many metres before it reaches the ground.

White Ash (*Fraxinus americana* L.) is common in the Missouri forest area, from which it has extended up along the eastern border of the state (22) to Sarpy County.

Green Ash (*Fraxinus lanceolata* Bork.) is also common in the Missouri forest area, from which it has spread westward and northward along the river valleys, across the state (24) to the western counties.

Red Ash (*Fraxinus pennsylvanica* Marsh.) is found with the preceding (23) and apparently has been disseminated with it.

Red Bud (*Cercis canadensis* L.). The bean-like pods are very flat and thin, and are well adapted to be carried in the wind a few metres. It is common in the Missouri forests and has extended northwestward into Nebraska (36) as far as Lancaster and Douglas counties.

The Maples (*Acer* spp.). The bicarpellary fruit develops two thin membranous curved and slightly twisted wings, one on the back of each carpel. At maturity the carpels split apart, and each falls slowly with a whirling motion, while the wind carries it to a greater or less distance from the parent tree. In a high wind this distance may be twenty to thirty metres, or even more.

Mountain Maple (*Acer glabrum* Torrey) is abundant in the Rocky Mountains of Wyoming and southward, from which it has extended eastward into the extreme western part of the state (42) at two stations (Sioux and Scott's Bluff counties).

Silver Maple (*Acer saccharinum* L.) occurs abundantly in the Missouri forest area from which it has extended up the Missouri River nearly to the mouth of the Niobrara River (43) and westward fifty to sixty miles, in the moist lands along the streams.

Box Elder or Ash-leaved Maple (*Acer negundo* L.) grows abundantly in the Missouri forests, from which it has extended across the state (44). As this species occurs in the Rocky Mountains from New Mexico northward it is possible that some of the trees in western Nebraska have come down from the mountains and met those disseminated directly from the eastern forest areas.

Ironwood (*Ostrya virginica* (Miller) Willd.). The small nut is enclosed in a bladdery bag, which is so much larger that it serves the purpose of a wing. A dozen or more of these are aggregated into a loose strobilus. The obvious purpose of this structure is the easy transportation of the seed by the wind either in the whole strobilus, or the separate seed-bearing bags. The tree is abundant in the Missouri forests, from which it has extended up through the eastern and northern counties to Brown, Cherry and Sioux counties (63).

Water Beech (*Carpinus caroliniana* Walter.). The small nut is attached to a foliaceous, somewhat three-lobed bract, which serves as a wing. These bracts are not crowded into a strobilus, but constitute a loose raceme. On falling from the tree the bracts serve to float the seed in the wind for some distance from the parent tree. This species occurs in the Missouri forests, and has been reported from eastern (Sarpy County) and northern stations (Brown County) in Nebraska (64) to which it has apparently extended its range.

The Birches (*Betula* spp.). The little nut is winged on its margins. These grow in small cones, from which when mature they are shaken out by the wind, and carried away some distance before reaching the ground.

Canoe Birch (*Betula papyrifera* Marshall). This tree occurs in Minnesota and Montana, the Black Hills of North Dakota, and at a single station on the Iowa River in central Iowa (Hardin County). In Nebraska it is found only on the bluffs and in the

ravines along the Niobrara River in Keya Paha, Brown, and Cherry counties (65). The occurrence of this tree in Nebraska is a puzzle to the botanical geographers, for it is difficult to conceive of any means by which the seeds could be carried from the nearest known stations. Even should we consider the possibility of its dissemination from the Black Hills the difficulty is nearly as great, for the distance is fully one hundred and fifty miles, a part of it across the very rough country known as the "Bad Lands."

Black Birch (*Betula occidentalis* Hook.) occurs abundantly in the Rocky Mountains west of Nebraska (66) and has extended from thence eastward into the state in Sioux County.

River Birch (*Betula nigra* L.) is found in the Missouri forests southeastward, and has extended its range northward along the eastern border of the state, being reported from Cass County (67).

HAIRS

The Willows (*Salix* spp.). The bicarpellary seed-pods contain two rows of inverted seeds (anatropous), each of which develops a circular tuft of long straight ascending hairs on its funicle. Upon the dehiscence of the mature fruit the seeds are released, when the hairs spread out almost spherically, and are caught by the winds and floated away for long distances, often a mile or more, or in high winds, many miles.

Black Willow (*Salix nigra* Marsh.) is common in the Missouri forests, from which it has spread up the streams, apparently across the state (5).

Almond Willow (*Salix amygdaloides* And.) is found abundantly in the Missouri forests, and has followed the river valleys across the Plains to the Rocky Mountains (6) and even to Oregon.

Shining Willow (*Salix lucida* Muehl.) occurs in the Missouri forests and has moved up the river to Cass County (7).

Sand-bar Willow (*Salix fluviatilis* Nutt.) is abundant in the Missouri forests, from which it has extended up the river valleys, across the Plains to the Rocky Mountains (8), California, and Oregon.

Bebb's Willow (*Salix bebbiana* Sarg.) is found in the Black Hills of South Dakota, and the Rocky Mountains from Montana to Colorado, from which it has extended eastward (9) so as to enter the northwest corner of the state (Dawes and Sioux counties).

Diamond Willow (*Salix missouriensis* Bebb) is common along the Missouri River in Western Missouri from which region it has extended its range northward along the river, and westward in the Republican, Platte and Niobrara river valleys to the western border (10).

The Poplars (*Populus* spp.). The bi- and tricarpellary seed-pods develop two or three rows of seeds having the same general structure as those of the Willows. On the escape of the seeds they are buoyed up by the attached mass of fluffy hairs, and carried away by the winds, sometimes for several miles.

Quaking Aspen (*Populus tremuloides* Michx.) is a Rocky Mountain tree which has extended eastward into Nebraska but a few miles in the western counties (11) from Banner to Sioux, Dawes and Sheridan counties.

Balsam Poplar (*Populus balsamifera* L.) occurs in the Rocky Mountains of Wyoming from which it has extended eastward into Nebraska in Sioux County (12).

Narrow-leaf Cottonwood (*Populus angustifolia* James) is also a member of the forests of the Rocky Mountains, from which it has come eastward into Nebraska (13) in Sioux and Scott's Bluff counties.

Rydberg's Cottonwood (*Populus acuminata* Ryd.) occurs here and there in the Rocky Mountains of Colorado and Wyoming, from which it has invaded western Nebraska (14) at one point (Scott's Bluff County).

Common Cottonwood (*Populus deltoides* Marsh.) is very abundant in the Missouri forests, from which it has passed up the rivers across the state (15) to the western border and beyond.

FLESHY FRUITS

Red Cedar (*Juniperus* spp.). The small few-scaled cones increase their parenchymatous tissue and become fleshy, and berry-

like. They are eaten by some birds, and in this way the seeds are scattered.

Eastern Red Cedar (*Juniperus virginiana* L.) is found scattered over the eastern United States, and occurs in the various bodies of forests eastward of Nebraska. From these it has moved westward up the river valleys fully two-thirds of the distance across the state (2).

Western Red Cedar (*Juniperus scopulorum* Sarg.) occurs in the Rocky Mountains, from which it appears to have moved eastward into the western third of the state (3).

Papaw (*Asimina triloba* (L.) Dunal). The large fleshy fruits which contain about eight large hard seeds are edible, and are picked up and carried off, or eaten directly by various quadrupeds. In either case it happens that some of the seeds are carried some distance from the parent trees. This species is very common in the Missouri forests, from which it has moved up the river valleys (4) in southeastern Nebraska (Richardson to Pawnee, Nemaha, Otoe, and Saunders counties).

Hackberry (*Celtis occidentalis* L.). The globose one-seeded fruits are fleshy, and are in fact small drupes, much like thin-fleshed cherries. They are freely eaten by birds, and thus the seeds may be carried to considerable distances (even to many miles) from the parent trees. This species occurs abundantly in the Missouri forests, from which it has extended its range up the Missouri, Republican, Platte and Niobrara river valleys, across the plains (20) to the Rocky Mountains.

Red Mulberry (*Morus rubra* L.). The compound fleshy fruit (sorosis) consists of an aggregation of small one-seeded drupes, each surrounded by the fleshy calyx-lobes. They are eaten by many birds, and the hard seeds are voided uninjured, and thus carried far away from the parent trees. The Mulberry is found abundantly in the Missouri forests, from which it has extended northwestward along the eastern border of the state to Cedar County (21).

Prairie Apple or Western Crab-Apple (*Malus iowensis* (Wood) Britt.). The fleshy fruit contains five two-seeded carpels, and is eaten by swine, cattle, sheep, horses, and probably by

deer, rabbits, woodchucks and a few other quadrupeds. Such fruits as are carried short distances and then dropped whole, or partially eaten, may supply seeds from which new trees may spring. This species is abundant in the Missouri forests, from which it has extended its range into Nebraska along the Missouri River and up the Niobrara River to Brown County (25). It has been distributed up the Nemaha River valley to Gage County, and the Platte River valley to Butler County.

The Hawthorns (*Crataegus* spp.). The fleshy fruits are in fact little apples with bony instead of papery carpels. The flesh is palatable and the fruits are eaten by many quadrupeds (as swine, cattle, sheep, horses, deer, rabbits, etc.) and by some birds which are attracted by the bright colors in most of the species.

Blackthorn (*Crataegus tomentosa* L.) occurs in the Missouri forests, from which it has moved up the river into the southeastern counties, from Richardson to Lancaster and Douglas (26).

Downy Haw (*Crataegus mollis* (T. & G.) Scheele) occurs in the Missouri forests, and has extended its range apparently with the preceding species to Lancaster and Douglas counties (27).

Red Haw (*Crataegus colorado* Ashe) is probably a western species which has moved down into the Sandhill region, where it occurs along the banks of the Dismal and Middle Loup rivers in Thomas County (28).

Thorny Haw (*Crataegus occidentalis Britt.*) is a native of Colorado, Wyoming and Montana from which it has moved down the Niobrara River to Cherry, Brown, Rock, Holt, Keya Paha, Boyd and Knox counties. It occurs also on the Middle Loup River in Thomas County (29).

Juneberry (*Amelanchier canadensis* (L.) Med.). The little hard-seeded apples have a soft edible flesh which is greedily eaten by birds. Many of the seeds pass through the alimentary canal uninjured and are thus distributed over considerable distances. This species occurs in the Missouri forests, from which it has moved up the valley of the Missouri River as far as Sarpy County (30).

Cherries and Plums (*Prunus* spp.). The monocarpellary, two-ovuled ovary becomes a fleshy one-seeded drupe. The hard shell of the stone protects the seed from crushing when the fruit is eaten by birds or quadrupeds, and preserves many of the embryos while the seeds are passing through the alimentary canal. The smaller fruits (cherries) are greedily eaten by many birds, while the larger (plums) are eaten by quadrupeds, and occasionally carried away by birds.

Choke Cherry (*Prunus virginiana* L.) is found in the Missouri forests, from which it has been carried northward along the Missouri River as far as Sarpy County, and westward in the Nemaha, Blue and Republican river valleys to Franklin County (31).

Wild Black Cherry (*Prunus serotina* Ehrh.) occurs in the forests of Missouri, from which it has spread into southern and eastern Nebraska, to Sarpy County along the Missouri River, and Franklin County in the valley of the Republican River (32).

Wild Plum (*Prunus americana* Marsh.) is common in the country East of the Plains, into and across which it appears to have been carried, so that it is now found in the Rocky Mountain region. It is found in all parts of Nebraska (33), even in the "pockets" in the Sandhills into which it must have been carried by birds.

Kentucky Coffee Tree (*Gymnocladus dioica* (L.) Koch). The large monocarpellary fruits (15–18 centimetres long, 4–5 wide, and nearly 2 centimetres thick) contain about half a dozen large, spherical, very hard seeds, imbedded in a sweet pulp. The ripened pods hang on the trees for a part of the winter, and when they fall are picked up by quadrupeds which are attracted by their sweet odor. The hardness of the seeds prevents their being crushed. The tree occurs in the Missouri forests, and has followed the Missouri and Niobrara rivers northwestward to Rock county (34). In the southeastern part of the state it has followed the smaller streams westward fifty to sixty miles from the Missouri River.

Honey Locust (*Gleditsia triacanthos* L.). The large twisted and bent monocarpellary fruits (20–30 centimetres long, 2–2.5

wide, and 0.5 thick), contain ten or more very hard, flat seeds, bedded in a sweet pulp. The pods fall from the tree during the winter and are picked up and partly eaten by the larger quadrupeds, as swine, cattle, etc., and doubtless were also by deer, buffaloes, and other wild animals before the advent of white men. The hardness of the seeds preserves them from injury. The tree is common in the forests of Missouri, and has been carried up the Missouri River and its tributaries so that now it occurs as far west as Franklin County in the Republican valley, and Holt County along the Niobrara River (35). It has also passed up the Nemaha and the Blue rivers to Gage and Lancaster counties.

Buckthorns (*Rhamnus* spp.). The small drupe contains two to four very hard one-seeded stones, surrounded by a thin flesh. When these drupes are eaten by birds the seeds are preserved from injury by their hard covering.

Buckthorn (*Rhamnus lanceolata* Pursh) is common in the Missouri forests, from which it has moved up along the eastern border of the state to Cherry County on the Niobrara River. It has followed the tributaries of the Missouri River (Nemaha and Blue rivers) to Gage, and (Platte River) Saunders counties (38).

Indian Cherry (*Rhamnus caroliniana* Walt.) occurs somewhat sparingly in the Missouri forests, from which it has advanced into eastern Nebraska (39) having been noticed at two stations (Cass and Saunders counties).

Buffalo Berry (*Lepargyraea argentea* (Pursh) Greene). The small red or amber one-seeded drupes are edible, and are eaten by birds and thus carried away. The seed is protected from injury in the alimentary canal by its hard covering. This small tree is a native of the Rocky Mountain region and westward, from which it has been carried eastward across the state (40) to the banks of the Missouri River (Nemaha County).

Sumach (*Rhus copallina* L.). The small one-seeded drupes are crimson in color and have an acid flavor. They are eaten by birds, and their seeds are protected from injury by the bony seed coat. This species occurs in the Missouri forests, and has been carried northward (45) to the extreme southeastern corner of the state (Richardson County).

ROLLING BALLS

Sycamore (*Platanus occidentalis* L.). The flowers grow in spherical heads, and produce compact, spherical clusters of oblong nutlets, which hang from long peduncles. When they fall from the tree (in the winter) they roll over the ground in the wind, carrying their seeds with them. These trees are common in the forests of Missouri, from which they have moved up along the eastern edge of the state to Douglas County (37).

EDIBLE SEEDS AND NUTS

Buckeye (*Aesculus glabra* Willd.). The large brown shiny seeds drop to the ground as soon as mature, where they are quite conspicuous. Here they are picked up by large animals and sometimes swallowed. They are too hard to be easily masticated, and many must be rejected after trial. In the meantime they have usually been carried some distance from the parent tree. This species occurs in the Missouri forests, from which it has moved into Nebraska (41) as far as Richardson, Pawnee, and Nemaha counties.

Walnuts (*Juglans* spp.). The large drupaceous fruits contain a bony shell (the nut) enclosing a four-lobed, edible seed. At maturity the bitter flesh rots away, leaving the nut, which is picked up by squirrels and related rodents, and carried away to be eaten at once, or hidden for future eating. Many of these are dropped on the way, or those hidden are forgotten or overlooked, so that much effective distribution of seeds has taken place.

Butternut (*Juglans cinerea* L.) is common in the Missouri forests, from which it has been carried into the southeastern part of Nebraska, as far as Gage, Johnson, Otoe and Cass counties (46).

Walnut (*Juglans nigra* L.) is found in abundance in the forests in the Missouri River valley southeast of Nebraska, and from here it has moved up that river and up the Niobrara valley to Cherry County. It has occupied the southeastern corner of the state, and the Republican valley to Harlan County (47).

The Hickories (*Hicoria* spp.). The fruits are drupes, with a hard flesh which splits at maturity into four segments and separates from the hard, smooth, but usually angled nuts, each enclosing a two- to four-lobed, edible seed. These nuts constitute the favorite food of squirrels, and are carried away and secreted in great quantities. Many of these eventually germinate and spring up into young trees.

Shellbark Hickory (*Hicoria ovata* (Mill.) Britt.) is common in the Missouri forests, from which it has been carried into the southeastern counties of Nebraska, from Gage to Cass (48).

Big Hickory Nut (*Hicoria laciniosa* (Michx.) Sarg.) occurs in the Missouri forests, from which it has been carried northward along the Missouri River from Richardson to Sarpy counties (49).

Mocker-Nut (*Hicoria alba* (L.) Britt.) occurs in the Missouri forests, from which it is reported to have moved northward (50) into eastern Nebraska (*Sargent*).

Pig-Nut (*Hicoria glabra* (Mill.) Britt.) is common in the Missouri forests, from which it has been carried along the Missouri River into eastern Nebraska from Richardson to Cass counties (51).

Bitter Hickory (*Hicoria minima* (Marsh.) Britt.) is common in the forests of the Missouri River valley, from which it has been carried northward into the southeastern counties of Nebraska (52) from Richardson to Pawnee, Lancaster and Cass.

Oaks (*Quercus* spp.). The fruits (known as "acorns") are thin- and tough-shelled nuts, each containing a single, large, edible seed. They are relished by squirrels and other rodents, as well as by swine, cattle and sheep, and also by deer and buffaloes. All of these no doubt have contributed in some degree to their dissemination, but the squirrels have been the most active agents in this work, gathering and hiding them in many places, usually at some distance from the parent tree.

White Oak (*Quercus alba* L.) is common in the Missouri forests, from which it has been carried into southeastern Nebraska (53) as far north as Cass County.

Post Oak (*Quercus minor* (Marsh.) Sarg.) is found in the Missouri forests, from which it is reported to have moved northward (54) into southeastern Nebraska (*Sargent*).

Bur-Oak (*Quercus macrocarpa* Michx.) is abundant in the Missouri River valley forests, from which it has migrated along the river valleys fully half way across the state (55), reaching Harlan County on the south, Custer County in the centre and Cherry County on the north. It occurs, also, in the Black Hills of South Dakota, to which it was probably brought from the same Missouri forest area.

Yellow Oak (*Quercus acuminata* (Michx.) Sarg.) found in the Missouri forests, has barely reached Nebraska (56) in Richardson County.

Low Yellow Oak (*Quercus prinoides* Willd.) of the Missouri forests has barely reached southeastern Nebraska (57) in Richardson County.

Red Oak (*Quercus rubra* L.) is common in the Missouri forests, from which it has been carried northward along the Missouri River to Dixon County (58) and westward fifty or sixty miles.

Scarlet Oak (*Quercus coccinea* Muench.) occurs in the Missouri forests, and has entered the southeastern counties of Nebraska (59) from Richardson to Cass.

Black Oak (*Quercus velutina* Lam.) is found in the Missouri forests, from which it has moved northward along the eastern border of Nebraska (60) to the Platte River.

Black Jack Oak (*Quercus marilandica* Muench.) of the Missouri forests, has moved into the southeastern counties of Nebraska (61), Richardson to Pawnee and Nemaha.

Laurel Oak (*Quercus imbricaria* Michx.) is found in the Missouri forests, from which it has moved northwestward nearly or quite to the southeastern corner of Nebraska (62). Although this species has repeatedly been reported from this part of the state, I have seen no specimens which were collected within our borders. I have specimens collected in Missouri but a short distance from the southeastern extremity of Nebraska.

DISCUSSION

From the foregoing statistics it appears that of the seventeen trees whose fruits or seeds are winged thirteen came into Nebraska from the southeast and four from the west. Of the eleven species with hairy seeds six came from the southeast and five from the west. Of the twenty species with fleshy fruits sixteen came from the southeast, and four from the west. The single species whose seeds are in rolling balls came from the southeast, and all of the species with edible nuts (eighteen) came from the southeast. The significance of these facts is not at once very obvious. They do not directly indicate the relative value of the several devices for dissemination, nor do they plainly decide the question of the efficiency of winds, waters, birds, and quadrupeds as carrying agents. Thus the fact that thirteen trees with winged fruits or seeds came from the southeast, and only four from the west, does not indicate the greater efficiency of the south-east winds over those from the west. The fact that there is a much more compact forest area, containing a greater number of species of trees of this kind a short distance southeast of the state, is of far greater importance. The nearness of a vigorous vegetation representing many species makes that vegetation more efficient in invading a territory. The Missouri forests dominate the forests of Nebraska, because they are near by, and contain many species. This is shown more emphatically in the case of the species with edible nuts, all of which have come from the Missouri forests, where they are abundant. In Wyoming and northern Colorado there are no species of this kind in the sparse forests within a hundred miles of the western border of Nebraska. There are no oaks, hickories, walnuts, or buckeyes in this portion of the Rocky Mountain foothills to move eastward. On the other hand, there are species of trees having hairy seeds not only in the Missouri forests, but also in the canyons of Wyoming, and here we find that almost one-half of our trees of this kind came from the west. It is to be remarked, however, that while five of the six southeastern species have crossed the state, the five western species have moved eastward only a few miles from the Wyoming line.

Of the thirteen southeastern species with winged seeds or fruits three barely enter the state, one has advanced one-fourth of the way across the state; three, one-half; one, two-thirds, and five to or beyond the western border. Of the four western species, two have barely entered; one has advanced half way, and one, two-thirds of the way across the state.

Of the sixteen species with fleshy fruits, seven have barely entered the state; six have advanced half way across the state; one, three-fourths, and two to the western border and beyond. Of the four western species two have advanced about one-fourth of the way across the state; one, three-fourths, and one has reached the Missouri River.

Lastly if we examine the eighteen species with edible nuts, all of which have entered from the southeast, we find that fifteen have barely entered the state; one has advanced nearly one-fourth of the way across the state, one, two-thirds, and one, three-fourths.

Summarizing what we have found, by assigning a definite value to the distance covered by each species and taking the aggregate of these for all the species, we find that the average of those with winged seeds and fruits is fifty-three per cent of the whole distance; for those with hairy seeds, fifty-two per cent; with fleshy fruits, forty-five per cent; with edible nuts, sixteen per cent; and with rolling balls, ten per cent. We can thus express the efficiency of each device in these per cents, as follows:

| | | |
|---|---|---|
| Wings on seeds or fruits | 53 | per cent |
| Hairs on seeds | 52 | " " |
| Fleshy fruits | 45 | " " |
| Edible nuts | 16 | " " |
| Rolling balls | 10 | " " |

That the migrating movement of the trees in Nebraska is still going on is attested by many observers, especially in the southeastern part of the state. The conditions under which such movement occurs are usually the following:— (1) Cessation of prairie fires, (2) protection from domestic animals, (3) a forest border in a moist valley. Under such conditions the forest bor-

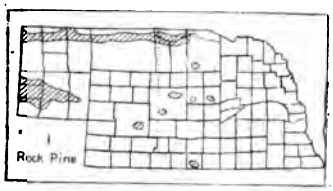
der becomes margined with tall-growing weeds which kill the tenacious prairie grasses, at the same time affording a lodgment for seeds of shrubs and trees. These grow, and gradually the shrubs and trees retain possession of the belt of ground, at first to the partial exclusion of the weeds, and later to their total suppression. Still later the trees overtop the shrubs, and eventually the latter may be suppressed also. While this is happening, a new weed belt is forming in advance of the belt of shrubs and young trees, and thus the forest margin is continually advanced.

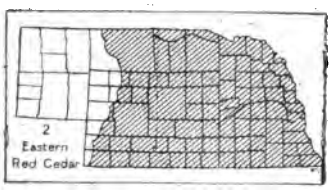
There are many such advancing forest borders in Nebraska. In fact wherever the fires and domestic animals are kept out such an advance is commonly taking place. The rate of advance varies from a few feet a year to a hundred feet under favorable conditions, and in exceptional cases to several hundred feet. When it is remembered that an advance of but ten feet a year along a forest border a mile long adds a little more than an acre of woodland, even such a slow advance is seen to accomplish much. In this way in the course of a century the actual forest area may be greatly enlarged. While such a steady advance of the forest margins is now actually going on, there is another mode of distribution which is even more rapid. A seed is carried by a bird or other means to a considerable distance from the body of trees of its kind. It springs up in its new station and eventually produces seeds, and becomes a centre from which further distribution takes place. A case of this kind has been brought to my attention in the recent appearance of the Linden tree (*Tilia americana*) in the vicinity of Lincoln.

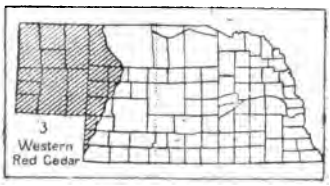
In the western part of Nebraska the present spreading of the Rock Pine (*Pinus scopulorum*) is quite noticeable. It is not uncommon to find young trees considerably in advance of the older trees of the sparse forest, around which are many small trees which have sprung up from the young parent trees.

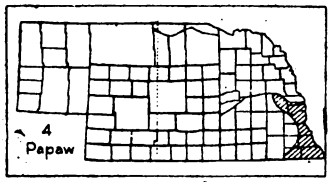
## MAPS SHOWING DISTRIBUTION OF NEBRASKA TREES

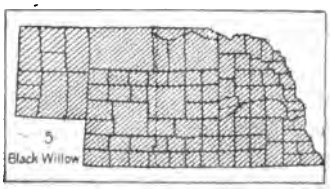
(Compiled from specimens and available data in the Herbarium of the Botanical Survey of Nebraska. The lines are drawn so as to show the general distribution of each species, it being impossible to show details on maps drawn to such a small scale. In some cases isolated stations have been connected where there is good reason for believing that the species extends from one to the other, while in others no such attempt has been made, although further investigation will probably show intermediate stations, if not an actual continuity.)

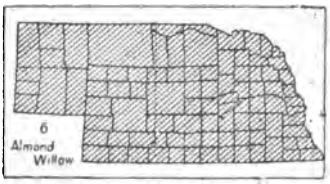

1
Rock Pine

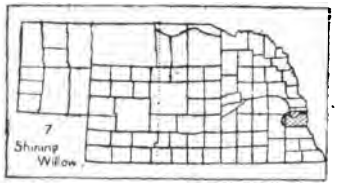

2
Eastern
Red Cedar

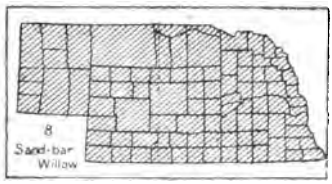

3
Western
Red Cedar

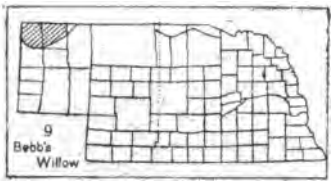

4
Papaw

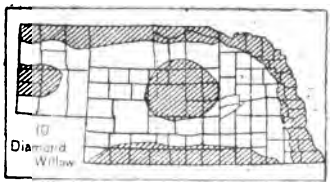

5
Black Willow

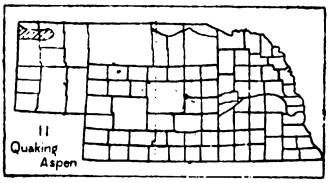

6
Almond
Willow

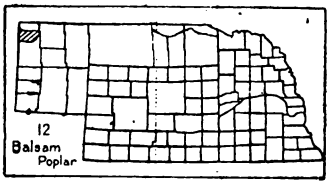

7
Shining
Willow

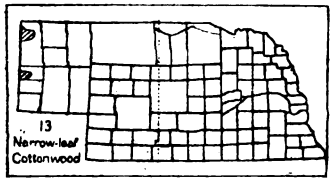

8
Sand-bar
Willow

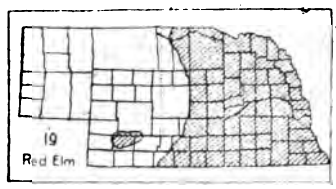

9
Bebb's
Willow

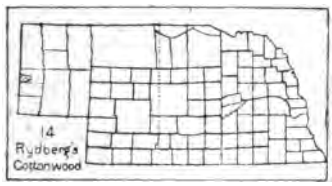

10
Diamond
Willow

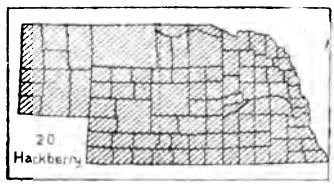

11
Quaking
Aspen

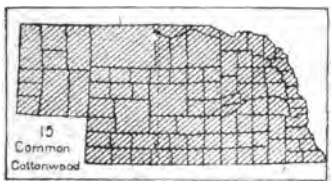

12
Balsam
Poplar

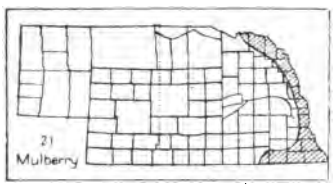

13
Narrow-leaf
Cottonwood

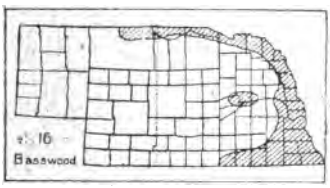

19
Red Elm

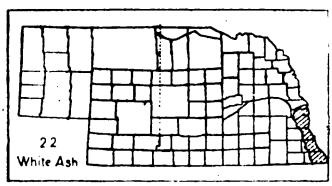

14
Rydberg's
Cottonwood

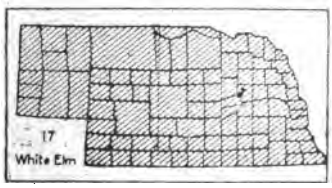

20
Hackberry

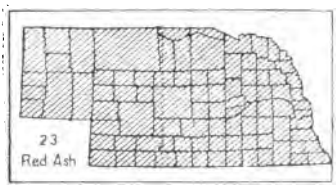

15
Common
Cottonwood

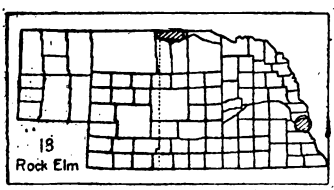

21
Mulberry

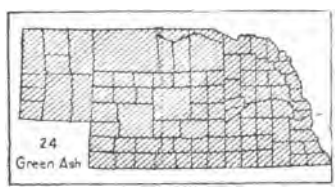

16
Basswood

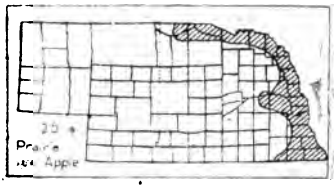

22
White Ash

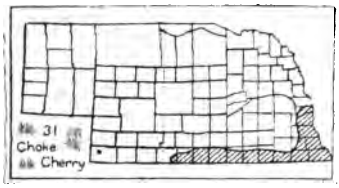

17
White Elm

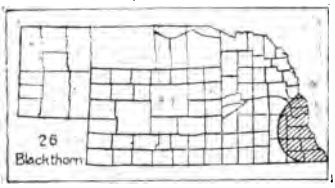

23
Red Ash

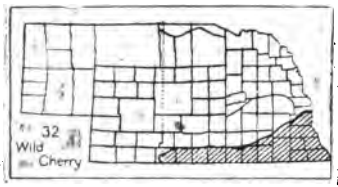

18
Rock Elm

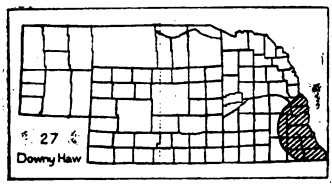

24
Green Ash

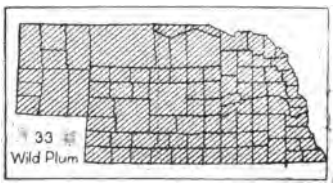

25
Prairie
Apple

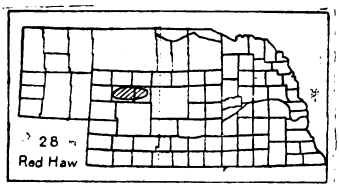

31
Choke
Cherry

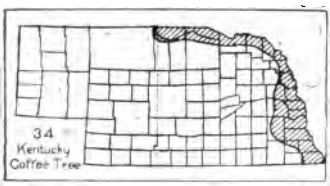

26
Blackthorn

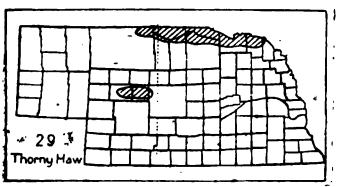

32
Wild
Cherry

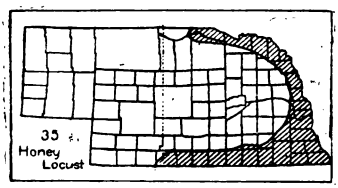

27
Downy Haw

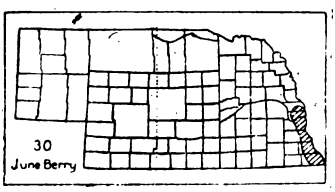

33
Wild Plum

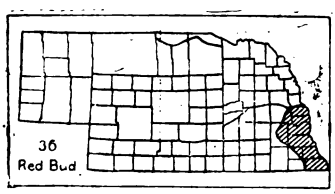

28
Red Haw

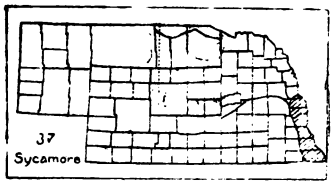

34
Kentucky
Coffee Tree

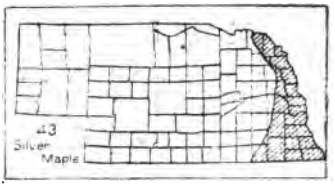

29
Thorny Haw

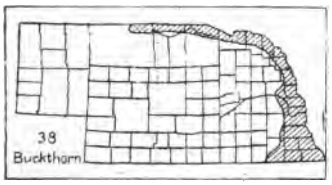

35
Honey
Locust

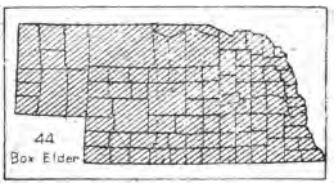

30
June Berry

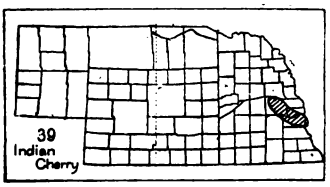

36
Red Bud

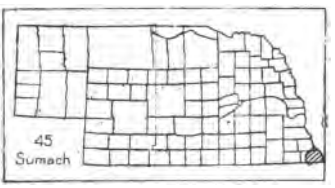

37
Sycamore

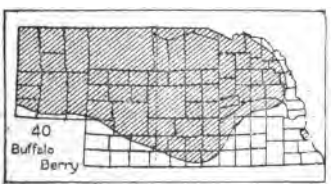

43
Silver
Maple

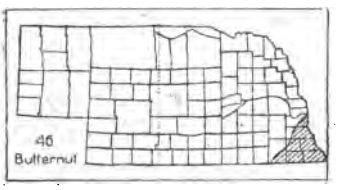

38
Buckthorn

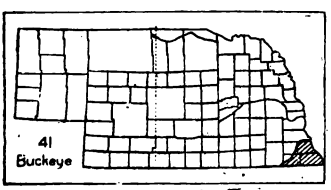

44
Box Elder

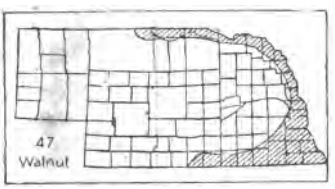

39
Indian
Cherry

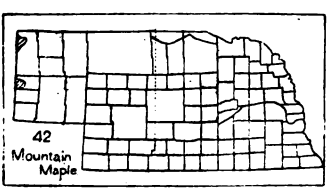

45
Sumach

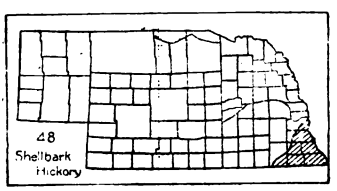

40
Buffalo
Berry

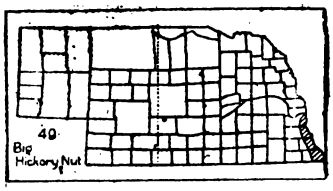

46
Butternut

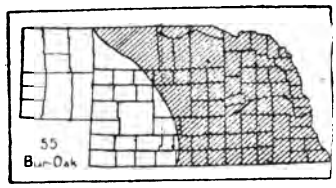

41
Buckeye

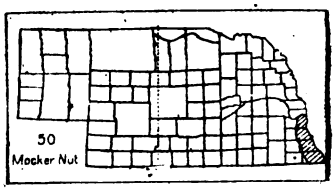

47
Walnut

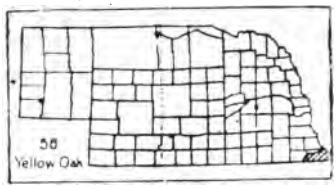

42
Mountain
Maple

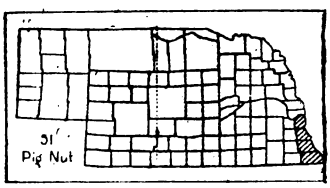

48
Shellbark
Hickory

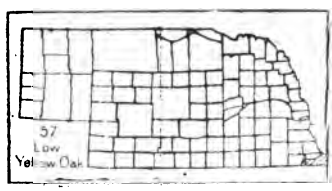

49
Big
Hickory Nut

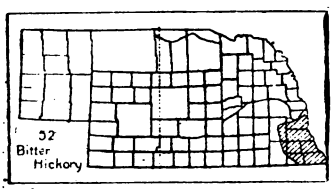

55
Bur-Oak


50
Mocker Nut


56
Yellow Oak


51
Pig Nut


57
Low
Yellow Oak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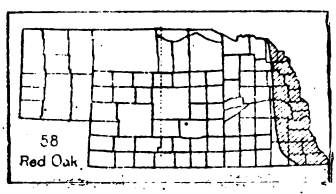
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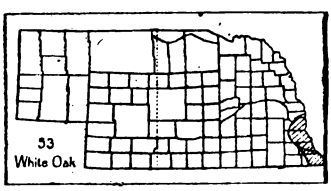
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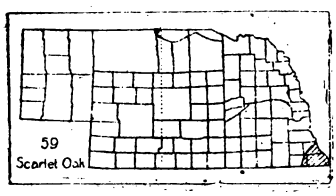
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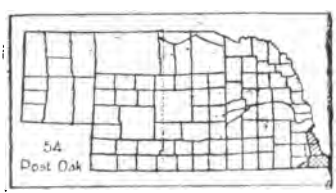
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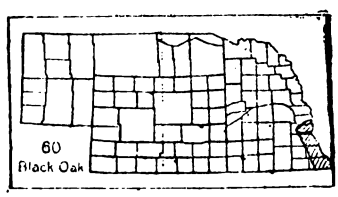
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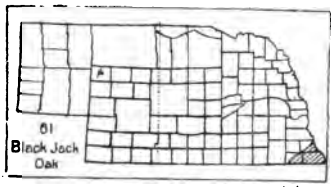
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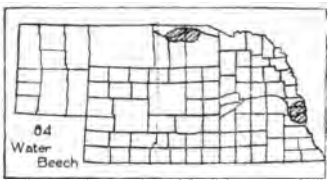
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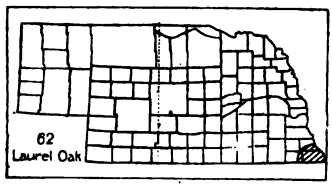
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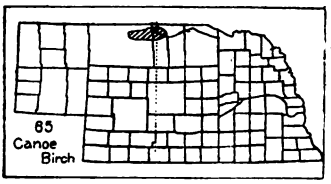
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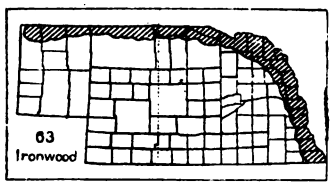
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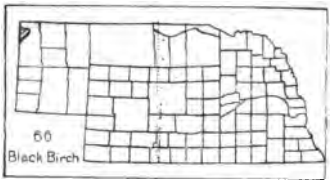
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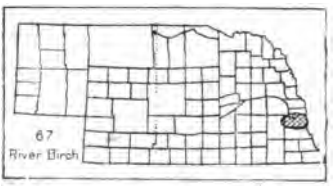
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## III.—*An English Version of Oehlenschlaeger's Hakon Jarl*

BY JAMES CHRISTIAN LINDBERG

### INTRODUCTORY NOTE

The tragedy *Hakon Jarl the Mighty* was completed toward the latter part of the year 1805 at Halle, Germany. The author, Adam Gottlob Oehlenschlaeger, wrote the work in Danish and later on translated it into German. It was first published in November, 1807, in *Nordiske Digte,* and was presented for the first time at the Royal Theatre in Copenhagen, January 30, 1808. Before this, Oehlenschlaeger had used the same materials in his poem, *The Death of Hakon Jarl,* which appeared in 1802. These materials were taken from the fragments of old Icelandic court poetry as given in the *Elder Edda.* In many cases Oehlenschlaeger departs from the historical facts, and he does not always present the incidents in their true chronological order.

The two principal characters, which alone will be considered here, are Hakon Jarl and Olaf Trygveson. The date of Hakon's birth is uncertain. When we find him in history he is the most famous of an already famous family, whose genealogy and notable deeds are celebrated by Eywind, the poet, in *Haleyia-tal.* His grandfather, Hakon I, fosterson of King Athelstan of England and a close friend and advisor of King Harald Fairhair, was Earl of Yriar. His father's name was Sigurd. Both were great men in their day as law-makers and famous for their power of organization.

Of Hakon himself we know very little until about the year 970 A. D. At this time the three Haralds, Graafeld, Blaatand, and Guldharald, were masters of Norway and Denmark. They were constantly at war with each other and each in turn sought the advice of Hakon. But Hakon was shrewd and in all his advice kept his own advantage in view, so that at each turn he was the gainer and they were losers. Graafeld, King in Norway, was lured from thence to Denmark, where he was killed by Guldharald. Scarcely was this done when Hakon himself, in league with Blaatand of Denmark, killed Guldharald and for this was made earl in Norway. He soon cast off this Danish suzerainty and for about twenty years, 976–995, was in all but name king of Norway.

As a vassal earl of Harald Blaatand, Hakon fought against the inroads of the German Emperor, Otho II, who wished to force the Christian religion upon Denmark. Compare *Corpus Poeticum Boreale,* vol. II, p. 45:

"He (the Danish king) bade the prince of the Hords, Hakon, defend the Wall against the king of the Logobards (Germans). . . . It was a hard fight when they joined shields; the earl faced Otho bravely, he turned the Saxons to flight. Thus he guarded the Wall against the army of Southerners" (*cf.* I, ii, p. 11 below).

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When he returned to Norway after this battle, he renounced the Danish suzerainty. Learning of this the Danish king induced the Wickings of Iom to go against the crafty and rebellious earl. The result was the famous Iomsborg's battle where Hakon won a glorious victory. It was in this encounter that the warrior Bue, who had lost both of his hands in the fight, when he saw that all was lost, sprang overboard, holding a heavy money chest under his arms (*cf.* I, ii, p. 16 below). It was also at this time, when the battle seemed doubtful, that Hakon gave as an offering his little son, Erling (*cf.* IV, ii, p. 75 below). Chronologically, Oehlenschlaeger puts this scene much later. In the *Iomswikinga-drapa* Bishop Biarni (*circa* 1200) says of this incident:

"Cruel was the song of the sharp swords! The blood dripped on the javelins! Brave was the defense. . . . On every side the foe gave way before them in the fight, till the cruel Hakon offered up his son in the midst of the battle."

This saving of Norway from the dreaded Wickings of Iom put down all opposition toward Hakon that had hitherto existed. He was heralded as the hero of the North and became the national idol. All Norway lay under his sway. Says Einar:

"I say that the gods strengthen Hakon's sway. Was there ever a land and sixteen earls lying so under one ruler? His glory soars high under the four ends of the heaven."—*Vellekla, Corpus Poeticum Boreale,* vol. II, p. 47.

While he was still in league with Harald Blaatand, he was baptized and acknowledged the Christian faith. But no sooner was he independent of the Danish king than he threw it off as lightly as he had assumed it, and again became a dutiful and zealous worshiper of Odin and Thor. By his enemies he was called the "sacrificing earl." During the reign of the Ynglings, everything was uncertain and unstable. Now all was peaceful, and while Hakon conducted himself wisely the country prospered.

But as the years passed he began to overstep his legitimate rights. The hero became the monster. The people were dissatisfied. Olaf appeared as a threatening cloud from the West. Hakon was put to flight and died at last at the hands of a treacherous slave. On this point Saemund the historian says:

"The stern Earl Hakon took the land after the dead Harald; one-score and thirteen years he ruled the country. The end of the life of Eric's father in Gaula-dale was not a good one, where Cark (in the play Karker) the thrall slit the throat of Hakon with a knife."—*Konunga-tal, Corpus Poeticum Boreale,* vol. II, p. 313.

About the year 995 Olaf Trygveson appeared in Norway. He was the son of Trygve, who was the grandson of Harald Fairhair. The poet Hallfred Vandraedascald, *Lives of the Kings, Corpus Poeticum Boreale,* vol. II, pp. 94–95, says the following of Olaf's viking exploits:

"He was twelve years old . . . when they launched his warship out of Garth (Novgorod territory). . . . He dyed his spear red in blood at Holm, and east in Garth. Who knows it not? I have heard how the Breaker of high-places piled heaps of corpses in many a place. The Hater of the Fanes made the kindred of the Iamts and Wends to fall in battle. He was trained early to that. He was a danger to the lives of the Gots, and I hear that he fought at Sconey. He hewed the mailcoats with the sword in Denmark, and south of Heathby Tryggwe's son cut down the coarse-grown carcases of the Saxons for the witches' chargers (the wolves), and gave the blood of many a Frisian to the steeds of the night-hags (wolves). He fed the wolves on the bodies of

the Gaulish Bretons, and gave the flesh of the Flemings to the raven. The young king waged war against the English, and made a slaughter of the Northumbrians. He destroyed the Scots far and wide. He held a sword-play in Man. The archer-king brought death to the Islanders (of the Western Islands) and Irish; he battled with the dwellers in the land of the British (Wales), and cut down the Cumbrian folk."

Oehlenschlaeger's reason for Olaf's appearance in Norway is not historical. He was not on his way to Russia as the play states, but came to christianize his native land and incidentally to claim his birthright to the throne. He succeeded in ridding the land of Hakon Jarl and in planting permanently the Christian faith. After five years in the midst of his activities he was overtaken by his enemies and fought his last fight at Svold.

So far as ascertained no complete translation of *Hakon Jarl* is extant. Mention should be made of a certain Mr. Gillies, probably Robert Percy Gillies of literary fame, who is spoken of in an unsigned article on *Hakon Jarl* in *Blackwood's Magazine*, 1820, vol. 7, p. 73, as having made—presumably from the German version—a translation of the play. Sampson Low's *English Catalogue* of Books (1835–1863) mentions a translation published by Hookam in 1840, but the translator is not named. Whether either of these translations was complete can not, from present means, be ascertained. For the chief sources, from which the author constructed five characters in the play, consult Vigfusson and Powell's *Corpus Poeticum Boreale*, which has been used, in definite citation, in references above made. The present translation is made from the text of F. L. Liebenberg, Copenhagen, 1895.

PERSONS

OLAF TRYGVESON.....King of Dublin.
HAKON JARL, called The Mighty.....Norway's ruling Earl.
ERLING.....His son.
THORER KLAKE.....A merchant.
CARLSHOVED, JOSTEIN.....Olaf's cousins.
EINAR TAMBESKIELVER.....A young archer.
BERGTHOR.....A blacksmith; spokesman of the people of Throndhiem.
GUDRUN, ASTRID.....His daughters.
ORM, THORVALD.....Their lovers.
THORA.....Hakon's mistress.
TANGBRAND.....A priest.
AUDEN.....An old, one-eyed man.
GRIB (Griffin).....Thorer's slave.
KARKER, STEIN, LEIF.....Hakon's slaves.
INGER.....Thora's maid.
A Messenger

*Priests, Warriors, Peasants, and Slaves.*

# ACT I

## SCENE I

### Hlade[1]

A square, with trees, before HAKON'S palace, upon which faces a row of buildings with open windows. KARKER and GRIB seated under a tree; beside them, dishes and ale-cups. Noise and sounds of revelry issue from the guest-rooms.

*Karker.* Hark, what noise! What boisterous revelry. That 's the voice of Thorer Klake, thy master, discoursing about his foreign travels.

*Grib.* He does rightly so. It 's worth the hearing, how shrewdly he bartered off his goods on every northern coast, and returned laden with stores of gold and silver. My master has a wise and cunning brain; he should have lived in the time of Harald Graafeld.[2]

*Karker.* And why just at that time?

*Grib.* He was a king who helped the trades and strove for the development of our land; a king who for Norway's welfare put aside the purple robe with all its gold and humbly dressed himself in sheepskin.

*Karker.* And *therefore* people called him Harald Graafeld?

*Grib.* Indeed, to his everlasting honor. He was a merchant-king. The trading vessel was his fleet, the yardstick his scepter. He was a noble hero.

*Karker.* Have a care and praise him not too highly. The Jarl rules us now and he dislikes that too much be said in praise of other men.

*Grib.* Thanks for this advice, my gentle friend.

*Karker.* No mention of thanks. But Grib, tell me something now. We know nothing about what goes on abroad, but must sit here and mope in irksome loneliness.

*Grib.* Ha! Would that we might enter the guest-room yonder, seat ourselves beside the board, and with hands unchained, seize the golden horn, as freemen do.

*Karker.* The gods defend us! What depraved words! Have a care, and be content with thy common lot. For all time, *we* are born to serve.

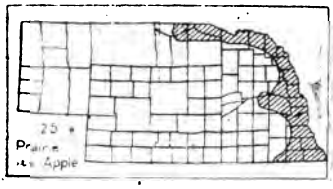
*Grib.* And thus thy languid soul is put to sleep?

*Karker.* And why not so? That which cannot be changed, must continue as it is.

*Grib.* Aye, that 's true, alas.

*Karker.* And after all what lack we here? Have we not prospered well? Thorer Klake fancies thee, Jarl Hakon me. Indeed thou dost not fare as well as I; thy master is only a merchant, mine an earl, and more than that the greatest earl in all the land. There are sixteen others who bow the knee to him;[3] in sooth, he is almost a king. Now then, should I not be content? Formerly I drove the plow, raked hay, and many a night I have slept in the sheep-fold. Now my clothes are soft, my food the very best; I have little to do, a cozy winter house, and I am seldom beaten.

*Grib.* In truth thou 'st found thy place.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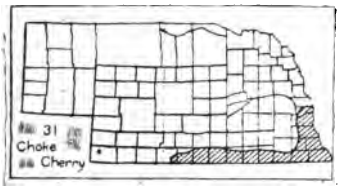
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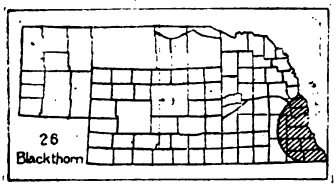
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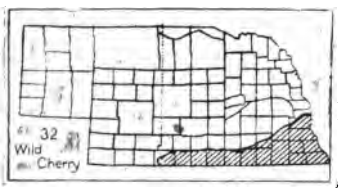
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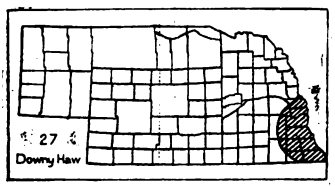
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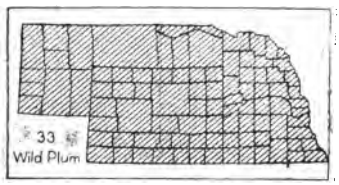
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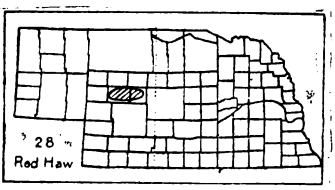
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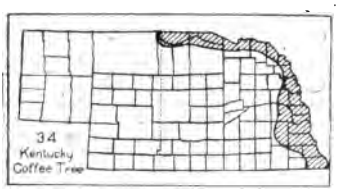
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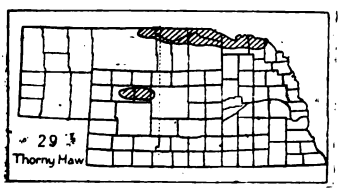
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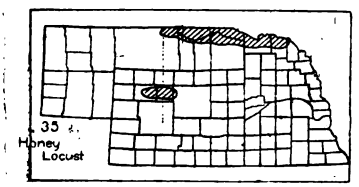
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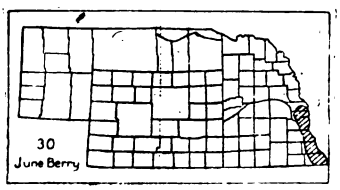
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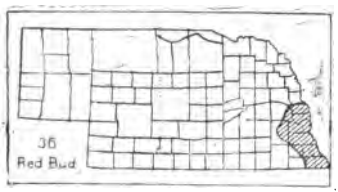
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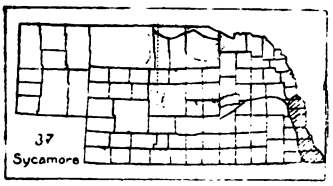
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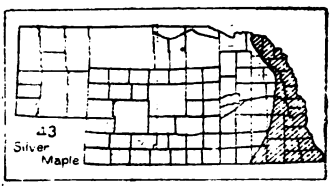
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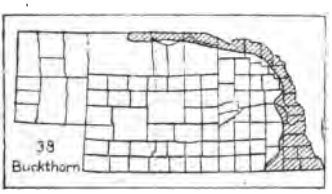
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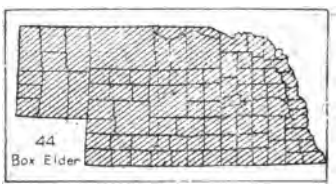
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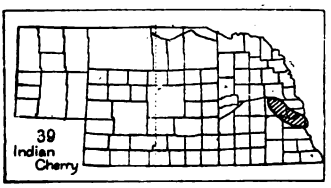
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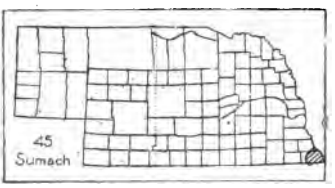
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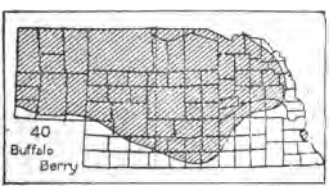
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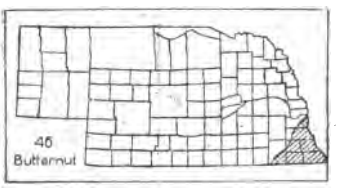
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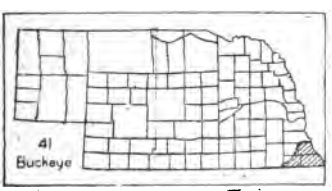
Butternut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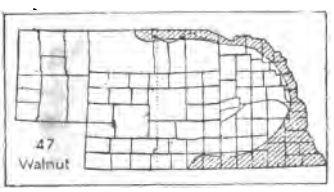
Buckeye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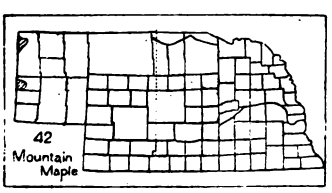
Walnut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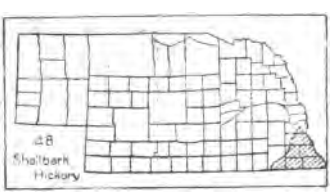
Mountain
Maple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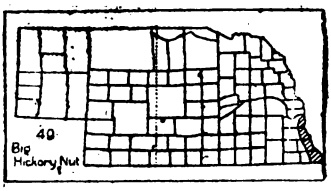
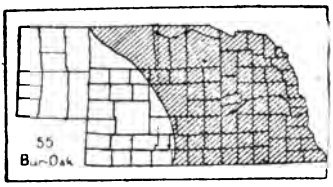
Shellbark
Hickory


49
Big
Hickory Nut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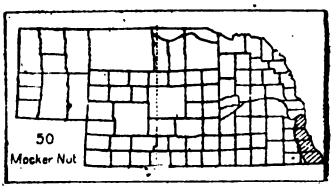
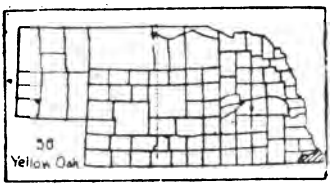
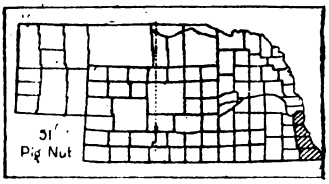
Bur Oak


50
Mocker Nut


56
Yellow Oak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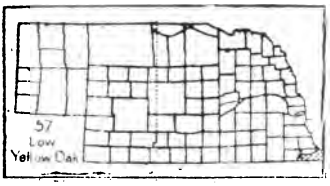
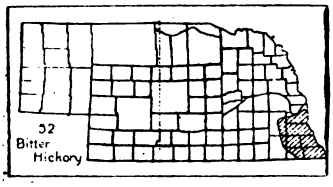
Pig Nut


57
Low
Yellow Oak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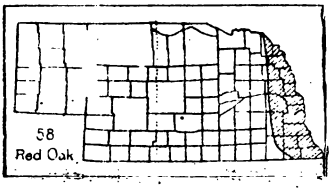
Bitter
Hickory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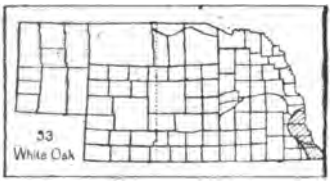
Red Oak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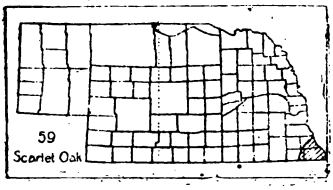
White Oak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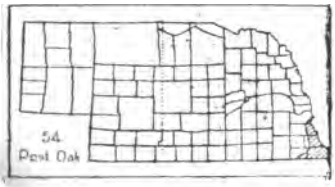
Scarlet Oak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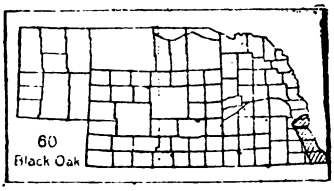
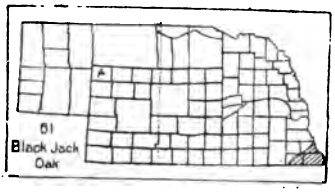
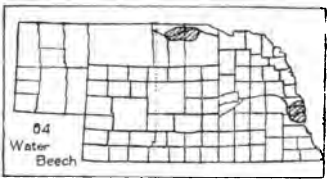
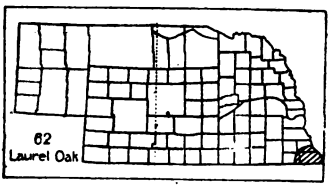
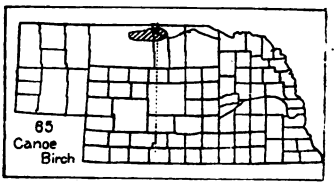
Post Oak

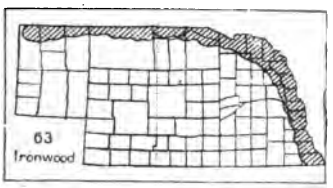

60
Black Oak

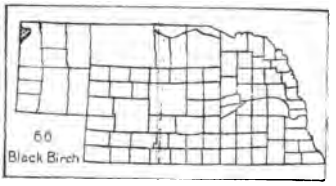

61
Black Jack
Oak

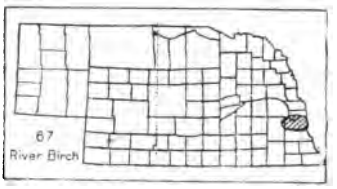

64
Water
Beech


62
Laurel Oak


65
Canoe
Birch


63
Ironwood


66
Black Birch


67
River Birch

An earl, should rule the realm. I'll soon convene
The court, and dauntless there present my wish.
The sturdy Bergthor, brave, old warrior-smith,
Is moiling hard to forge my royal crown.
When that is done, th' assembly will convene.
*Thorer.* Whate'er may chance, even now thou art a king.
*Hakon.* A merchant thou, and moved alone by gain;
But outward splendor need not be despised,
And that I 've sought with all my craft and power.
A maiden's fond embrace is not so blest,
As is the kingly crown's about the brow.
Almost the goal is reached; my daylight fades
And evening bends beneath its weight of dew,
As Eivind Skaldaspilder's ballad says.[11]
My raven locks are changing fast to white
Give me thy hand.

[THORER *extends his hand;* HAKON *takes it, and downcast speaks.*]

Recall how once I pressed
Thy hand so hard that from its nail-roots blood
Burst forth, as juices forced from ripened fruit.
Come, tell me truly, didst thou feel my grip?
*Thorer.* No clasp of hand should make a friend complain,
No matter how severe.
*Hakon.* My grasp was not
Severe. Thou mockest me now! Behold my brow,
With furrows deeply plowed.
*Thorer.* Such furrows much
Adorn a man.
*Hakon.* They please not Norway's maids.
In short, my friend, I age too fast, too fast!
I feel it now; but mark! I am resolved
To fill my eventide with joy; my sun
Shall calmly set aglow with purple splendor,—
And woe the cloud that dares obscure my sky.
*Thorer.* Aye, aye, my lord! But where 's the cloud?

*Hakon.* Where else
But in the west? Just where it must not be.
*Thorer.* Dost speak of Olaf, Dublin's king?[12]
*Hakon.* Aye, him!
Unquestioned lies his right in straight descent
From Harald, him of golden hair.[13] My friend,
Thou knowest well our Norway's peasant folk:
A race of heroes, noble, true and brave,
Yet superstitious, ruled by prejudice.
I 'll wager my achievements, even myself,
Would be forgot in Olaf's kingly birth,
If once the rumor spread that he yet lives.
*Thorer.* Dost thou believe —
*Hakon.* Believe? Indeed! Believe!
Ah, Thorer mine! I know my people well.
This wild fanatic, aye, this traitor bold,
Shall he ascend the throne?
*Thorer.* A traitor, lord?
*Hakon.* I stood at Danevirke[14] with my men,—
A Norseman every one. To Harald's[15] aid,
The son of Gorm, we went. This Olaf helped
The Christian Otto, aye, our Southern foe,
To burn the bulwark of the North. A traitor?
This word displeases thee? And still is not
He such, who proves disloyal to his gods?
*Thorer.* Disloyal? Olaf never has embraced
Our northern faith.
*Hakon.* A scoffer of our gods,
Shall he acquire, ascend, old Norway's throne?
*Thorer.* Who harbors such a thought —
*Hakon.* I, I, my friend!
And Olaf too, perhaps. Excepting him,
The lineage of Harald[16] is extinct.
My noble race is all as strong as his;
From olden time, the mightiest next the king.
And nearest to the crown, was Hlade's Jarl.
Now none were left. A mere enthusiast,

Who disavows our northern creed and faith,
A ransomed thrall, whose mother gave him birth[17]
While journeying through a wood, — the father dead.
A desert child! 'T is easy thus to claim
A royal birth. He shall not hinder me.
By Valhal's[18] everlasting gods, I swear!
Sublimest Aesir![19] Ne'er shall he assail
Audaciously your power. Almighty Odin!
Thou mighty Aukathor[20] and Freia!

[*He turns to the background towards the statues and notices* GUDRUN.]

Ha!
What's this I pray?

*Gudrun.* Most noble Earl! Forgive!
Forgive! I perish quite from fear and shame.
I know the law forbids us to approach
The silent sanctuaries of the gods.
Forgive me, noble lord.

*Hakon.* [*Surprised.*] A fairy maid!
What brings thee to this grove? To overhear
Our speech? I am appalled! Thou here, a spy?

*Gudrun.* By Freia, by mine innocence, I have
Not heard a single word. I would have gone
Before, but that I feared to fall and so
Betray my —

*Hakon.* Pray, what brought thee here?

*Gudrun.* Ah me!
Necessity compels me to confess:
I am thy smith's, the aged Bergthor's, daughter,
Affianced bride of Orm; and therefore, sir,
I 've bound this wreath for Freia's head and risked
Intruding here, to decorate the brow
Of my protecting goddess. Pray, forgive me!

*Hakon.* A happy meeting this; most fortunate!
Thou art the fairest among the woodland maids;
And so enraptured youth have christened thee
"The Sylvan Sun."

*Gudrun.* Ah, sir, let me descend!
I give thee solemn promise never more
To enter here.
*Hakon.* [*To Thorer.*] By Freia, wondrous fair,
Come, pretty babe, let Hakon help thee down!
[*Takes her upon his arm and carries her to the front of the stage.*]
A feather's weight, luxuriant as a flower.
A bud, half blown, that 's opening to the sun.
Now tell me, pet! Art thou not pleased to sit
On Hakon's mighty arm?
*Gudrun.* By everything
That's holy, sir, I pray thee let me down.
Dishonor not thy Aesir's hallowed grove!
*Hakon.* [*Sets her down, with an anxious look towards the statues.*]
Dishonor? Ha, I marvel how so fair
A mouth can speak a word so indiscreet.
How like a child! What hands! So soft and white! [*Kisses them.*]
*Gudrun.* By everything that's holy, let me go!
*Hakon.* [*Places his arm about her.*]
And secretly hath Bergthor kept thee hid.
And when I wished to see thee, thou hadst gone,
Perhaps to visit—Thor knows where—thy aunt
In some far distant vale?
*Gudrun.* And what, I pray,
Couldst thou desire to see in me, in me,
Betrothed, a peasant's bride? He 's jealous, sir!
If he should come, — Oh let me go!
*Hakon.* If he
Should come? What horror? He! I would announce
Myself a bidden guest, nor by my troth
Would I forget the wedding gift.
*Gudrun.* Release—
*Hakon.* Thou never shalt escape from Freia's grove
Ere first thou givest me a kiss.

*Gudrun.* O gods!

*Hakon.* Oh gods?' How now? Proud Norway's doughty Jarl,
Soon Norway's king, is he denied a kiss?
Must I so long entreat?

*Gudrun.* I die from fear.

[*He forces a kiss from her. She hastens away.*]

*Hakon.* Ha! Like a hind she flees; and this old bear
No longer swift, can only look and long.
But wait! Aye, wait!

*Thorer.* My Hakon! Sir!

*Hakon.* O what
A charming creature! Saw you not her hair, —
Those heavy golden braids, with fillets bound?
And then her arm! How plump! What tender eyes
Of quiet blue! Her ample bosom heaved
As if 't would burst the silver chain that clung
About her throat.

*Thorer.* My lord! My Earl!

*Hakon.* O what
To this is Berglioth's[21] beauty; where, alas,
Compared with Gudrun's lies our Thora's charm?

*Thorer.* By Odin, she is fair. But noble lord,
Forget not why we came; remember, thou
Didst come to tell thy servant secret things
Of state, of larger import.

*Hakon.* Larger import?
Thou frozen lump of ice! Is 't possible
No spark of passion smolders in thy breast?
Ha, feel of mine! There 's yet the lusty stroke
Of youth. And why desire to be the lord
Of this extensive realm, unless—unless
To satisfy my craving, — yea, my right,
To pluck the flower no matter where it grows.

*Thorer.* But Olaf, noble lord!

*Hakon.* Ah, that is true!
'T was well I saw her then, and yet she vowed

She nothing heard; I 'll not mistrust her; no!
She 's innocence itself, by which she swore.
Here Jostein and Carlshoved come; 't is them
I waited for. [*Enter* JOSTEIN *and* CARLSHOVED.

*Hakon.* [*Goes to meet them.*]
You 're very welcome all!
Here have I now my rarest friends; I would
I had a hand for each.

*Carlshoved.* Our noble lord,
Our greatest pride is this, that we are friends.

*Hakon.* You two already know what long I 've had
In mind, and why we seek this private place.
But Thorer here, whose shrewdness much I need,
To execute my scheme, is only half
Informed. So hear me now: Amid the storm
And strife of war, my life is spent; and many
A stone, and much entangling copse were cleared
Before this fir stood free to rear its head
And thrive through strength bestowed by mighty Thor.
Ye are my friends; in you I may confide
My heart's intent. My name is honored far
And wide, throughout the North. I 've fought my way
Till now, I stand as Norway's greatest man;
Alone my foe denies me what I am.
The weakling, Harald Graafeld and his brothers
Corrupted all the land; with each deprived
Of strength, no one possessed the power to assert
Himself, and thus maintain his inborn right.
Like gnomes at play they tumbled right and left,
Until they died a mutual death. Alone
Was Harald Graafeld an opposing force,
And I confess, my stratagem was served,
Through chance, by that which birth had given him.
I 've treated ill, they say, this merchant Prince.[22]
And how, I pray? A recreant traitor he,
Who, tired of wealth, betook himself to me;[23]
Desiring that his brother share the realm

With him; and I betrayed his confidence,
Lured Harald Graafeld out, — and all, for what?
That I myself might gain. Unworthy he,
As was the merchant Prince, to wear a crown.
At Limfiord[24] fell they both, and Halse holds
Their common grave, the end of foolish greed.
And Harald Bluetooth then assumed the crown,
Unshared, and all through me. That later, I
Defied him, when he asked for homage, toll,
Entire submission, brought me no reproach
From Norway's sons. My every act, and most,
My last exploit at Hjöringsvaag[25] at which
The might of Iomsborg sank, — when Bue[26] sprang
Disheartened, overboard, his crippled arm
About the money-chest,—have shown the power
And shrewdness I possess. Now slowly sinks
My sun; a lingering hour of twilight still
Remains, and that shall not be darkened. No!
But one of all the ancient stock remains:
And he, you think, is fully satisfied
On Britain's throne? What sayst thou, cautious friend,
If I should tell thee Trygve's son is here?

*Thorer.* Here?

*Carlshoved.* Here in Norway!

*Jostein.* Olaf Trygveson!

*Haken.* It forced a smile, my Thorer, when this morn,
Thou didst with clever look, suggesting great
Importance, tell about thy kingly friend
In Dublin, pious Trygveson! As if
For all these years my watchful eye hath slept,
Though silent then, the time to speak has come.
Then know: These tidings came today from boats
That hourly guard the coast, that Olaf takes
A fleet to aid the Russian Valdemar[27]
But on his way has stopped at Norway's coast,
To visit, so they say, his fatherland.

*Thorer.* King Olaf? Olaf? Is it possible?

*Hakon.* Perhaps it is a childish whim that makes
Him pause midway, perchance to fill his lungs
With mountain air; I neither know nor care
To know. But this, as you perceive, I must
Find out, if underneath this artless halt
There lurks not something else. I watch him close.
Thou, Thorer, art his friend; how like a friend
That thou shouldst visit him, when thou dost know
Of his arrival here. The wind is friendly.
Tomorrow thou art there, when daylight breaks.
Then, Thorer, grant me this one small request, —
To sail to him; and while, as friend thou tellest
Him what thou wilt, keep silent strange reports.

*Thorer.* And what, my lord, is thy design?

*Hakon.* Even as
I say, unravel Olaf's real design,
But most of all to set for him a trap.
Thou 'rt clever, shrewd, and wont to deal with men;
An easy task for thee to cause delay,
Till quickly I am there with all my ships.
His own ships tarry near him; force to force,
'T is ever thus that Northmen fight. Can one
Complain at this, I ask?

*Carlshoved.* No, surely not.

*Thorer.* But how solicit him to stay, my lord?

*Hakon.* Why strike the chords, that flatter most his ear,
Or, chant the song, that pleases him the best!
Or tell him how (none better knows than thou)
O'er Norway hangs a cloud of discontent,
That people murmur much at Hakon's rule;
That peasants, here and there, alone await
Their cue, a valiant lord. Entice him then
On shore; I 'd rather meet him on the land —
I 'm growing old, and sicken on the sea.
If then, he tarries not, but quickly leaves
As first he planned, unheeding, though the crown
Implores and beckons him to stay, — why then

He 's honest, — I have done him wrong, — he seeks
The sea; my mind 's at rest.
*Thorer.* A well-formed plan,
My Jarl! I 'll do thy wish as best I can.
*Hakon.* 'T will not be unrewarded, noble friend.
*Thorer.* I know, I know, my lord! The Jarl rewards
Full like a king; thou knowest my faithfulness.
*Hakon.* [*Presses his hand.*] My honest Thorer!
*Carlshoved.* If Olaf came, perchance,
To sack our coasts, he 'll meet opposing power,
Or if he came a spy, he clumsily
Entraps himself.
*Hakon.* Perhaps, as Olaf's kin,
Ye too will go, and Thorer's word confirm?
*Jostein.* Our kinsman he, but thou our lord, our Jarl,
Our friend! Our presence there will only aid
In testing Olaf's innocence.
*Thorer.* Well said,
My friend!
*Hakon.* [*Draws his sword.*] Then here upon this shining glaive
In Odin's presence, swear before the gods,
To succor me.
*All Three Men.* By Odin, Freia, Thor,
We swear!

[*In the background Odin's statue falls down.*]

*Jostein* Ha! what was that?
*Carlshoved.* God Odin fell!
*Thorer.* Lies buried deep in dust.
*Hakon.* [*Calms himself, and approaches the statue.*]
This brittle stone
For months has had a deep and open rift.
Come hither, look — 't is dark — but see, the breach
Is old; a tiny portion held it fast
Which easily the slightest wind could burst.
You 're all dismissed! Tonight beside the board

We 'll meet and consummate our plans. Each one
To his, and leave me here alone! Before
You sail we 'll gather round the evening meal.

[*Exeunt* THORER, CARLSHOVED *and* JOSTEIN.

*Hakon.* [*Stands long and silently looking at the broken stone.*]

This old? Ah no; it is not old; 't is new.
Almighty Odin! Wherefore fell thy statue?
Art thou displeased? A warning this for me?
Thou 'rt covered deep with dust, while Freia stands
All smiling, decked with flowers. Does all this mean
That Southern love shall conquer Northern strength?
Ah, Odin, leave us not; wipe out a foe
That hates thee, mocks, and ridicules thy might. [*He kneels.*
I covenant here a worthy offering!
No less than nine and ninety blackest kine;
And all my foes for thee I 'll slaughter, if —
If only thou wilt grant me Norway's crown,
That golden, beauteous, dearly purchased crown.
In praise to thee the sacrificial bowls
Shall send their fumes to heaven; with reeking blood
The door post shall be painted red. And I
Myself will plunge the sword in Olaf's breast.
From Dovre's solid stone[28] a second statue
I 'll raise, and that defies eternity. [*Rises.*
Now darkness with its dusky veil entombs
The earth. [*Stands for a moment quietly gazing, then says*]
I 'll visit Bergthor and my crown. [*Exit.*

## SCENE III

### *Bergthor's Workshop*

*Enter* BERGTHOR *with a crown and a hammer in his hand;* GRIB *with a light.*

*Bergthor.* Put down the light and bring me the anvil. Though the day grows longer, it is dark this evening and still there is much to do.

*Grib.* Thy hands are apt and quick.

*Bergthor.* If thou dost wish to come and blow the bellows, and help me in other ways, thou mayst while thy master stays at Hlade.

*Grib.* I have nothing else to do, sir, and time drags slowly on. To live with the other slaves is small enjoyment; and what else is there to do? May Thor bless thee many times since thou dost pity me, a wretched thrall. Is it time to blow the bellows?

*Bergthor.* No, no. Leave it alone, thou rogue; hand me my file.

*Grib.* Thou knowest how to do things.

*Bergthor.* Do things! What dost thou know about such? Thou shouldst have seen me in my youth when I forged for King Hakon Athelstein.[29] Ah, that was workmanship! A sword indeed that pierced the hardest rock, or living flesh with equal ease. This crown moves slowly towards completion, and yet there is time, plenty time!

*Grib.* But why that sigh? It is almost done.

*Bergthor.* Almost done? Thou speakest like a fool. These precious stones must first be set. [*Enter* GUDRUN.] How now my daughter, what brings thee here thus out of breath.

*Gudrun.* My dearest father, Hakon Jarl has seen me.

*Bergthor.* Where?

*Gudrun.* In the grove.

*Bergthor.* Have I not forbidden thee to enter that grove to gather weeds and flowers? The blessed gods be praised, thou wilt soon be wed, and I relieved from all this toil of guarding thee. [*Hammers on the crown.*] Listen boy, I would rather fashion twenty crowns than guard two simple girls and keep them chaste; believe me boy, such ore is very frail indeed, aye, frail indeed!

*Gudrun.* Father, I am much afraid that Hakon is coming after me. What then will Orm say?

*Bergthor.* Is coming after thee? My Hakon, nothing good will come of this; I know thee well. Come hither child, down in the celler with thee!

*Gudrun.* And must I now be locked underground again?

*Bergthor.* Perhaps thou hadst rather be locked in Hakon's arms?

*Gudrun.* May Baldur help me, no!

*Bergthor.* I know him well; there is not a man who lives in peace because of wife or daughter, or sister, or mother, or even grandmother! Down I say, into the cellar, quick! No rest for me before I have placed thee safely under lock and key. Away, I say! Where is thy sister?

*Gudrun.* She prepares the evening meal.

*Bergthor.* That I can do myself; to keep you safe from Hakon's lustful eye is much the harder task. Away, away! Tomorrow I will send you both away,—thee to thy Orm, and her to Thorvald. Then they must take the blame perchance aught should happen to you after that. [*Exeunt.*

*Grib.* [*Looks with quiet wonder at the crown, which lies upon the anvil.*]

And this is the way the crown looks! And this is the way it is made. And when it is done, Hakon puts it on his head; then the people swear, and then he is king. That's very queer. [*Takes it in his hand.*] How bright it is; made of solid gold. And heavy! I wonder how many pounds it weighs? I wonder if it fits me? [*Places it on his head.*] It's too large; still I can carry it, although it sinks upon my shoulders. There! This way it fits. A crown is n't as light, I see, as I thought; I can hardly keep my head straight. [*Walks up and down the room.*] Now I am a king! [*Takes the file.*] Here,—this is my scepter! And yonder is my kingly throne. [*Seats himself upon the anvil.*] Now I am sitting among my men at the council.

[*At this point* HAKON *enters unnoticed; he remains in the background and watches* GRIB *attentively.*]

*Grib.* I herewith promise you, proud Norway's sons,
That I will be to you a gracious lord,
Provided you will choose me for your king;
But if, with insubordination, or

Defiance you resist in anything
Whatever I may ask as just and fair,
You 'll quake beneath my heavy hand.

[*Becomes aware of* HAKON *and is dumb with fear.*]

*Hakon.* Well done.
My lad, well done.
*Grib.* Sir, be not angry with me!
*Hakon.* Thou tremblest on the throne, my boy? That ne'er
Becomes a king. Though round about him raves
The storm, though earth's foundations shake, and death
Seems nigh, above it all he calmly clasps
His spear. A kingly, bold, imposing look —
The clouds disperse, the sky is clear, and once
Again the sun resplendent shines and gilds
His throne.
*Grib.* I 'm sure thou 'rt right. I feel that I
Was never born to rule.

[*Bergthor enters with a large bunch of keys, which he hides when he sees* HAKON.]

*Hakon.* Good evening, sir.
*Bergthor.* All hail the Jarl!

[*Becomes aware of* GRIB *who is seized with fright and dares not move.*]

By Vauland's help![30] What means
All this?
*Hakon.* He plays the king.
*Bergthor.* [*Half aside.*] It seems that this
Is quite the fashion lately. Down, I say!
Are people all gone mad!
*Hakon.* I came too late
And heard not more than half he pledged the King.
Is he thy swain?
*Bergthor.* He 's my apprentice, Thorer Klake's thrall.
*Hakon.* And thou dost trust a slave with Hakon's crown?

*Bergthor.* An interruption came; I had to leave
My work to place my daughters under lock
And key; meanwhile the rogue has dared —
*Hakon.* How, sir, —
Thy daughters?
*Bergthor.* Aye, my lord! Of late thou sawst
The one, and now she fears, as well as I,
That thou 'lt renew thy gaze. The cellar holds
Her now! Tomorrow morn I 'll send for Orm,
To whom she's pledged, and when he comes we 'll hold
Their nuptial feast; then he must guard his own.
*Hakon.* But father Bergthor! Pray what whims are these?
Art thou aware that this offends me?
*Bergthor.* Hush!
A tender spot, indeed, my Jarl; we 'll touch
This boil no more. Come now, assay the crown.
I 've found a ring of iron, rescued first
From Melhuus' temple ruins,[31] handed down
From son to son. My father's father forged
The swarthy Halfdan's[32] crown from this; although
The ring is old and quite consumed with rust,
It measures still our ancient crowns. Let 's see!

[HAKON *puts on the crown, which slips down over his eyes.*]

How now, too large! It dims thy vision like
A settling cloud.
*Hakon.* [*Incensed.*] A monster thou! Have I
Not given thee my measure? Where is it?
*Bergthor.* Thor knows, somehow 't is lost; and so I thought
That Hakon's crown should not be smaller made
Than Halfdan's.
*Hakon.* Bergthor! Bergthor, thou art old,
Sagacious, honest, bold, and skilled in art.
I spare thee now, but misuse not my mercy.
I grant thee two days more and woe to thee
If Hakon's crown then fits not Hakon's head. [*Exit.*
*Bergthor.* [*Looks after him proud, yet touched.*]
Thou threatenest what? My hair is white; three hours,

Or four perhaps, I 've left, — of these dost wish
To rob me? Think you Bergthor trembles like
A slave when thou dost scowl? Ah no! He 'll die
Beside his sword, but Norway's crown shall ne'er
Be changed. He wears the crown who worthy is. [*Exit.*

## ACT II

### SCENE I

**The Island Moster**

Woods and mountains. In the background the ocean. OLAF, TANGBRAND, and *Warriors* approach from the seashore, followed by THORER KLAKE, JOSTEIN, and CARLSHOVED.

*Olaf.* Now this is friendship of the truest kind,
My Thorer. Sail the seas all night to meet
Me here. Thou 'rt right; an hour's delay and thou
Hadst found me gone. Propitiously the winds
At midnight changed and urged us to embark.
But pray, my Thorer, how wert thou informed
That I was here?

*Thorer.* By merest chance, my lord,
'T was told me yesterday at Hakon's board;
A skipper brought the news. Thy kindly ways,
Thy hospitality has all but won
Stout Norway's heart. King Olaf's kindness came
To mind when out on stormy seas my ship
Sprung leak. Enchanting was the night, so bright
And clear; the wind was brisk; unworthy I
Thy love, had I not hastened here to greet
Thee on our northern soil. Our veering course
Was not our greatest care, but rather this:
Perhaps the fickle winds that hindered us,
Were driving thee from Norway's coast.

*Olaf.* I trust
That Hakon Jarl is not displeased because
I briefly visit thus my fatherland?

My ship alone lies anchored in the bay;
The rest are not dissuaded from their course.
One apprehension, quite unfounded, I
Foresaw, and hence took all precaution not
To rouse alarm. But who are these, my friend?
*Thorer.* Thy worthy kinsmen, sir, whom thou dost now
Embrace, — Carlshoved he, and Jostein there,
Maternal cousins; gladly they have come
To clasp their kinsman's hand.
*Olaf.* My cousins, they?
A double welcome then, twice dear to me.
*Jostein.* Receive thy country's greetings, Ola.
*Olaf.* Ola?
Thy speech betrays the honest dalesman; round
And full thou roll'st the "l"; I never learned
It thus; while yet an infant I was forced
To flee my native land. Our kinship then,
Is on my mother's side?
*Carlshoved.* Thy mother, sir,
Was Astrid, sister to our father, Halfdan.
*Jostein.* Just so, my lord.
*Olaf.* And hence we 're cousins, we?
You both resemble Astrid; still I see
That face, though early she was torn away.
Thou, Jostein, hast her dimpled cheeks, and thou
My Carl, art heir to all her golden locks.
*Carlshoved.* We 're glad thou seest her counterpart in us.
*Olaf.* Now tell me friends, how fares our goodly land?
I sail, perhaps you know, to Russia's aid;
My foster-father Valdemar is dead,
And all the land is filled with restlessness.
His son, Ivan defends the Christian faith,
And so I hasten to his aid with men
That stoutly wield the sword, as well as those
Who reverently bear the cross. When I
Embarked, I never thought of Norway; yet
When through the mists I saw her lofty cliffs

Adorned with fir, my heart began to swell;
A tender longing seized me; suddenly
There came to mind, a ballad, strange and long
Forgotten, from my childhood days. The tears
Of memory burned my cheeks. The sail, which bore
The ship away, relaxed; the pennants each
Unfolded, eagle-like, their purple wings,
As if they strove to rend their cords and reach
The shore. 'T was quite against my heart for me
To hasten by. Where lives the son who when
His mother beckons him, with loving eyes
And outstretched arms, could coldly turn aside?
To silence all mistrust, I landed here
Upon an island, here where no one lives,
Where only now and then the herdsman plants
His hut behind the cliffs. But now, before
I journey farther, — who can know if yet
Again my eye shall see this blessed land.—
Pray tell me Thorer, how our Norway stands?

*Thorer.* Our Norway stands on solid rock, a firm
Foundation, sir, that is not lightly moved.

*Olaf.* 'T is true; I know it! E'en white-bearded Odin
With all his cosmic power cannot compel
Your hills to quake, although for centuries
He 's threatened it.

*Thorer.* Then know, my lord, the state
Stands firm; luxuriantly the timid birch
And haughty fir, lift up their heads; the sun
Hurls down his golden shafts and ripens all
Our fields. With fruitless rage, as in all the past
The scornful waves besiege our coast. But still
My lord! while thus in calm composure hills
And valleys thrive, a deadly poison gnaws,
Consumes our nation's heart.

*Olaf.* How so, I pray?
Does not your Hakon calmly occupy
The throne?

*Thorer.* Indeed, my lord, for eighteen years.
But now our peasants feel, how base
It is to pay allegiance to an Earl.
*Olaf.* Just so; but why not name him king?
*Thorer.* Can such
A question come from Halfdan Svarte's stock?
*Olaf.* What cares the peasant Norse for Halfdan Svarte?
*Thorer.* Much more than thou surmisest. The sons of Thor,
Intrepid, bold, unswerving in their faith,
Have always reverenced their rightful king.
*Olaf.* And yet this Earl has ruled for eighteen years![33]
*Thorer.* What power, what cunning he employed to lift
Himself to his position thou dost know
As well as we. No one denies that he
Is brave; his keen perception, rarest type
Of judgment, — these have made him what he is.
Thou knowest how matters stood; how Gunhild's sons[34]
Ran wild; through childish weakness wasted, lost
The veneration due their rank. The Jarl
In easy battle conquered all. Thereto
Was added Denmark's friendship through her king.
The man who fights to win must first explore
The field, and such a man is Hakon Jarl.
And so unnoticed, like the crafty merchant
Who bargains only for his private gain,
He soon possessed the upper hand. Worn out
By war, the peasant longed for peace. And thus
Serenely Hakon sat upon his throne.
What made his power complete was Jomsborg's fight[35]
In which, to Norway's honor, he repressed
A youthful heresy that hitherto
Had terrorized the North.
*Olaf.* And now in peace,
Surrounded by his hard-gained splendor, you
Forsake the man?
*Thorer.* How very natural,
My lord! At first was Hakon wise; he knew

'T was wisdom clinched his power. He soon became
The nation's greatest idol, honored far
And near. "Jarl Hakon, Jomsborg's hero," shrieked
The crowd; "what power withstands the man; what shakes
His might?" And thus admired, undone by fame,
His head began to swim. He soon forgot
His former prudence, quite ignored the truth, —
The nation's strongest pillar must remain
The peasant's love. He then abused his power;
Becoming indiscreet, he slacked the rein
To every craving of his heart, and each
Deep-rooted passion played at will. No more
At peace, his heart was proud; he longed to rule.
No longer he respected private rights,
But seized the peasants' lands and stole their goods.
Indeed, far worse than that, he even took
Their wives, their daughters, dragged them to his home,
And offered them in sacrifice to please
His lewd desires. Unnoticed, everywhere,
The flames began to smolder. Heeding not
A foreign foe, he seemed unmindful of,
Or noticed not, the cancer gnawing deep
In Norway's heart. His power is waning, here
And there in daily bouts, while Norway waits
With longing for a valiant, lawful prince
To seize the throne and strip the Earl of all
His strength.

*Olaf.* My Thorer, hast thou spoken true?

*Thorer.* There stand thy cousins, sir, let them confirm
My words.

*Olaf.* My friendly Jostein, where are now
Those dimples in thy cheeks? Thou smil'st no more.
Art thou not pleased that Norway casts away
Her thralldom chains?

*Jostein.* [*Much disturbed.*] I 'm all too young, my lord
To know my country's real advantage, yet,
What Thorer said is quite correct.

*Thorer.* I need
Not tell thee how I felt, King Olaf, when
I learned that thou wert here. I thought the news
Had reached thee of our evil state,—that thou
Hadst seized this hour as opportune. But now
That thou hast spoken, now I recognize,
Astonished, that this is heaven's call.
*Olaf.* My friend!
Thou 'st deeply stirred the quiet of my soul.
*Thorer.* As stirs the seed that germinates and sprouts
Beneath the soil to blossom later on.
Thou 'st not forgot what blood is coursing through
Thy veins?
*Olaf.* [*Deep in thought.*] Is 't not, I pray, from Harald, he
Of golden locks?
*Thorer.* Upon the side o' the sword,
In straight descent.
*Olaf.* Whose mother Ragnhild dreamed
About a tree: while resting on the grass
She drew a twig from out her pouch and while
She held it in her hand, it grew a branch
Of wondrous size, whose lower end took root
In the mellow earth. The vigorous top reached up
Toward heaven, and stretched so high her eye could scarce
Behold it more. The trunk was large and round,
And near the ground was red as blood; above,
The trunk was smooth and of a tender green;
The limbs were white and broadly arching spread
Themselves and covered all the North. Such was,
I think, her dream?
*Thorer.* So says the myth, my lord!
*Olaf.* Was 't not King Harald with the golden hair
Who strangely dreamed about his locks? How some
In wavelets reached the ground, and some his knees,
And some his shoulders; others still did cling,
About his brow in tender curls?

*Thorer.* It was,
My lord! Accordingly our wisest men
Have prophesied: this dream foretells how great
Will be the royal race, that after him
Shall rule the North.

*Olaf.* [*Stands in deep meditation.*]

*Thorer.* What virgin thoughts are waking in thy soul?

*Olaf.* What virgin thoughts? Not so; my thoughts are old
And cherished; dreams of youth, and manhood's fond
Ambition.

*Thorer.* Worthy of thy birth. Forgive
Me, lord; but why hast thou not claimed before
Thy right, by birth, to Norway's crown?

*Olaf.* It seemed
So far away,—'t was occupied. Besides
My mind was filled with other thoughts. The soul's
Eternal rest outweighs the thrones of all
The earth. Its craving, hitherto, has drawn
Me toward the South, where Christian faith is taught.
Still fortune ne'er forsook me; twice have I
Been chosen king. 'T was love that forced me leave
The Wendish[36] sceptre; aye, 't was love recrowned
Me on the Irish throne. But never once
In all my life, in all my ramblings, here
And there, have I forgot my proper place,—
The North, there born of kingly blood. Full oft
The thought has stirred me: seize the sword, defend
Thy rights by birth! But everywhere I heard
That Norway's peasants throve, were satisfied
With Hakon Jarl. What power had I? One needs
Must have a mighty force thus to invade
A well-contented land. And could I not
Be Norway's king, I could not wish myself
The sole disturber of her peace.

*Thorer.* But now
The times have changed. When Throndhiem's[37] peasants hear
That Harald's great-great-grandson lives, then naught

Can hinder the espousal of thy cause;
They 're thine when thou dost enter Throndhiem's fiord.
Thy cousins' aid and mine,—I need not here
Assure thee, we are thine. And know beside:
That Norway's strongest, ablest men, desire
To offer thee their friendship, their entire
Devotion. Wishing thus to be the first
To bring this goodly news, we hither sailed
Last night. If thou dost wish to follow friends'
Advice, go not on strange adventure, seize
Thy Norn's, thy fortune's call; for not in vain
They 've beckoned thee to land.

*Olaf.* [*After a brief silence.*]
These tidings overwhelm me. Leave me, friends,
A moment! Yonder 'neath a tree, is raised
A tent. Refresh and rest yourselves. I 'll come
Anon. Attend them.

[THORER, CARLSHOVED *and* JOSTEIN *go, followed by* OLAF'S *men.* OLAF *and* TANGBRAND *remain.*]

Ah, my Tangbrand, thou
Hast stood there silent and absorbed—

*Tangbrand.* And glad
At heart because thy fortune smiles, and crowns
Thee king of this illustrious realm.

*Olaf.* A race
Of heathen men, who mock and jeer our God.

*Tangbrand.* The larger, sir, thy glory will become
When thou hast turned them from their evil ways.

*Olaf.* Yes, Tangbrand! yes, I 'll follow heaven's call.
And yet I had determined first to go
To Russia.

*Tangbrand.* Yet no promise has been made.
An unconfirmed report has lured thee out.
Thou 'rt wont to do, to act, hence thou didst tire
Of ceaseless rest, and yearned for deeds, as well
Becomes a Christian; deep within thy breast

There stirred that sweet desire to plant the faith
Of Christ in all the earth.
*Olaf.* And Tangbrand, think,
The first shall be the precious fatherland.
*Tangbrand.* As king of Norway, thou canst better aid
The Russian Ivan, if indeed thou must.[38]
*Olaf.* One's duty first concerns his blood, his kin.
To win this land for Christ,—inspiring thought.
*Tangbrand.* Aye! Norway first, and, Garderike[39] next.
*Olaf.* But Tangbrand—nothing I conceal from thee—
My heart rejoices not from pious zeal
Alone, it swells with ever increasing joy
To think of gaining back its own. My birth
Assures me Norway's crown. Now tell me, Tangbrand,
Doth Olaf sin, to crave his rights by birth?
*Tangbrand.* As sure as there 's a God in heaven who loves
Us all, no, Olaf, no! Rightly to use
The joys of earth without extremes, in thought
Or deed,—such is to see the Father's love.
Ah, well for him who sees in earthly joys
A mere reflection from the glory found
Above! And well for thee, if thou dost thrive,
As shepherd, leading forth thy Christian flocks.
*Olaf.* Go, pious father; leave me, go! I needs
Must be alone.
*Tangbrand.* Christ strengthen thee, my son. [*Exit.*
*Olaf.* [*Falls upon his knees, hands folded.*
My heart dissolves with joy; sublimest thought!
Most holy Christ, am I thy humble tool,
Thy chosen instrument, to spread abroad
Thy glory here on earth? My father, see,
I yield, thy kingdom come, thy will be done!
[*Rises from his knees inspired.*
I feel it, ah, I feel it! Yes, my arm
Is strong. Within my breast I feel a strength
Divine. Henceforth, O Christ, I 'm thine Apostle.
With this my sword, Deliverer, which bears

The semblance of the cross,—with this my sword,
I 'll fight and conquer each effrontery
That dares oppose itself against thy will.
As chosen shepherd of this beloved North
Shall Olaf keep the charge entrusted him.
Where Odin's shrines have stood all gloomy, dark,
Where blameless blood has cried aloud to Heaven,
Henceforth, to Thee, shall incense, myrrh, arise.
No more shall heathen drench their gods with blood;
No expiatory sobs; no heartless cries
From Odin's priests about the livid corpse.
But strains of gentlest harmony, from harp
And voice, shall hover round the throne of all
Eternity. With true devotion all
Shall meet beyond, transfigured,—all with thee.
The pangs of poverty shall be forgot;
No vulgar feasts shall then pollute thy church;
Alone the silent, awe-inspiring feast[40]
Shall there announce: Whatever is, is God!
Away with hatred, murder, brutal force,
For innocence and love shall be supreme. [*Exit.*

## Scene II

### Hlade

*A Path through the Woods*

Hakon Jarl *comes armed with sword, shield and bow.* Thora *meets him.*

*Hakon.* [*Pauses, somewhat uneasy.*]
Ha, who goes here? My Thora! Also thee
This summer day hath beckoned to the woods?

*Thora.* What beckons thee? Not Thora! Come perhaps
To visit me? I see that thou art armed.

*Hakon.* For warfare, Thora, — ready, thou must know,
With all my men to board the ships. We sail
Against a pirate who with impudence
Is ravaging our coast.

*Thora.* How glad I am
To see thee once again, before thou 'rt gone.
*Hakon.* Thy charge I left with Karker; he will bring it.
*Thora.* Thy slave, thy thrall!
*Hakon.* Even so, my time was brief.
*Thora.* O Hakon, Hakon!
*Hakon.* Pain me not with doubts!
*Thora.* Thou lovest me no more!
*Hakon.* And were it so,
Dost think, perhaps, that thy reproach hath power
To light the flame anew, perchance it waned?
*Thora.* And I must suffer this? I whom in all
The world thou lovedst the most? O faithless man!
What honeyed words thy flattering tongue devised!
'T was I alone could brighten Hakon's life,
'T was I alone could melt his iron heart
Or change its fickleness to constancy.
And like a fatuous fool I trusted thee,
Renounced my house, my home, my honor, yea,
My very soul I gave, and now — but I
Deserve the shame!
*Hakon.* What shame! Among the charms,
Among the excellencies, which I found
In thee, was also this, that thou wert free
From prejudice. Thou speakest of fickleness,
While thou art guilty of the same offense.
Where is now thy former optimistic view
Of life? Thou sayest thou gavest thyself to me?
That 's true; thou madest me happy. What of that?
Was he a youth, whose heart the wily moon
Could melt, who won thy love? Didst thou not say
That thou didst prize me first among the men
Thou 'st known? What most becomes a man, — to sigh
And ever sigh in lover's arms? Thou wert
A charming widow; slowly came and passed
The empty hours. What sacrifice was thine?
Of noble station, independent, rich,

Thou canst if thou dost choose, disdain report,
Contemn reproach. Together we enjoyed
Our days as lovingly as any pair
In Freia's hall; now other things absorb
The hero's spirit. Rashly, people here
And there have dared to murmur, talk aloud,
While pirate ships infest our coasts. All this
Must stop; and Norway's greatest man must not
Be found asleep. The present gives no time
For love's sweet jests. My Thora, be content;
For yet a while, return to thine estates.
The briefest absence strengthens feeble love.
We meet again, and doubly fond will be
Thy Hakon's love.

*Thora.* Thus all is settled, all!
This paltry, feeble stream of words requites
Thy Thora's loyalty, thy Thora's love?
But I deserve it; yes, by all the gods,
Deserve thy sordid faithlessness. Thou callest
Me wise and shrewd? Indeed I 'm shrewd enough
To see, that words are wasted which would try
To light anew the love within thy icy heart.
And yet this prompt audacity, this calm
Effrontery — acquired by countless practice —
This lack of mercy, lack of modesty,
This lack of sympathy for all my pain, —
This crushes me, this drives me mad. [*She weeps.*

*Hakon.* By Freia!
I love thee still, my Thora! Had I planned
To disappoint thee, which thou seem'st to think,
I 'd ne'er assume this calm repose of mind;
Thou dost mistake.

*Thora.* [*Excited.*] Thou liest, adulterous man!
By Syn,[41] thou liest! Thou dost summon Freia
To witness? Ha! Swear not by her.
Thy false behavior. Fornicator! Bah!
Can I have loved thee? Yes, I loved [1]

The only one who brought thee artless love
Was Thora. Rank was naught to me. My strain
Renowned and famed, dates back as far as thine.
Bewildered as I was, I thought to cleanse,
Regenerate thy heart, to make thee chaste
And lovely. Odin! When was Loke[42] true?
But vengeance, vengeance, Hakon! I have friends
And brothers! Better men than thou. I swear
By Asa Odin, they shall punish thee.

*Hakon.* [*With excited coldness.*]
Too fast, too fast; thou hast lost thy breath; take time!

[*He calls.* KARKER *comes.*]

If thou hast more to say, behold, there stands
My thrall; tell him the rest. It ill becomes
The Jarl to hear such weak abusive words
From an excited woman. [*Exit.*

*Thora.* Shameless knave!
What brings thee here?

*Karker.* Thou 'st heard my master say,
I 'm here to be abused.

*Thora.* [*Strikes him.*] Slave, reprobate!

*Karker.* My noble lady, oh, beware! Thou 'lt bruise
Thy hand upon my back.

*Thora.* [*Calming herself.*] Ha, Thora! You
Debase yourself. Where 's now your rank, your pride?
Thou fool, begone!

*Karker.* My master's orders bid
Me not begone.

*Thora.* What are his orders, pray?

*Karker.* That I announce, thy carriage waits to drive
Thee home to Rimol.

*Thora.* This then, is the charge
That thou shouldst bring, wherefore thy master lacked
The time? 'T is well; he is our common lord.
I freely yield; I go without delay. [*Exit.*

*Karker.* [*Calls the other slaves. They come.*] Lady Thora went home just now, and so there is to be a moving. Now bear yourselves discreetly. She is a little cross-grained. In case you act as if something broke, it 's likely she will strike you in the face. That 's the way I fared. O, it tickled my soul. She has two of the daintiest, softest, whitest hands you ever felt; why, it seemed to me as if she buried my nose in a silken pillow.

*Leif.* Aye!

*Karker.* You see she would like to have stayed longer. I am sure she would, but that would never do. It won't do to make the others stepchildren. This morning a crowd of our thralls went to Lunde, to bring Gudrun, Bergthor's daughter; she steps into Thora's place.

*Leif.* Again a new one?

*Karker.* Again? One sees that you are a novice at Hlade, otherwise you had said, "At last another?" For two long months was Thora here; this won't do as you yourself can see, if it must go the round of all the land.

*Leif.* The round of all the land?

*Karker.* [*Demonstrative.*] Indeed, it must be so. Our Jarl who carries so many things in his head, and who must look after us all and who must always be where there is trouble, and who must look after us all, and who carries so many things in his head, you see? We can't exactly blame him for this, him, who carries so many things in his head, who must always be where there is trouble, that he ——

*Leif.* Yes, yes, I understand you so far.

*Karker.* Besides, tell me this dear friend, upon your conscience, if you were an earl, and might have whatever you found good, would n't you have all the good you found?

*Leif.* Indeed, whatever I found good, but not what I found bad.

*Karker.* Bad? Thor defend us! Bad? One sees that you are a novice and never heard the speeches of wise lords. Otherwise you would know that such a man who carries so many, many things in his head, and who must always, always be where there is trouble, and who must look after us all, that he ——

*Leif.* Yes, Karker, I understand.

*Karker.* [*Angry at being interrupted.*] Then let me hear what it is that you understand.

*Leif.* You mean that such a hero, waking all the day for Norway's men, at night may sleep with Norway's women.

*Karker.* Exactly so, correct, thy reasoning is natural and sound. [*Exeunt.*

## Scene III

Einar Tambeskielver has in the meanwhile entered and seated himself upon a tree stump in the background, getting his bow in readiness; when the thralls go out, he arises, and looks in the opposite direction.

*Einar.* Who loiters idly down the road? By Thor,
It 's Hakon Jarl, returning from the ships.
Let 's see! I 'll play the Jarl a trick! They say
That nothing ever frightens him.

[*Places an arrow in the bow and shoots out from the scene.*]

Ha, ha!
I 've struck the bushy crest from off his helm.

*Hakon.* [*Runs angrily with sword uplifted towards* Einar, *seizes him at the throat and says:*]

Ha, purchased hireling! quick, I say, confess,
What have they promised thee for Hakon's life.

*Einar.* [*Calmly.*] Ah, nothing sir; I never asked for aught.
I 'm not a hireling either; I may boast
A noble birth; thou knowest my parents well.

*Hakon.* Who art thou, traitor? Speak, reveal thy kin.

*Einar.* My father's name is Manhood, sir; thou knowest
Him well, a crabid fellow, old, but brisk,
Alert for all his years; his beard is thick,
His arm is strong; his rugged health he drew
From Norway's mountains.

*Hakon.* Manhood? Villain! Die!

*Einar.* [*Holding his arm firmly.*]

May all the gods be praised who gave me strength
To master Hakon's arm; or else I 'd breathed
My last.

*Hakon.* What wrinkled hag hath willed to thee
Her art, that baffles Hakon's brawny arm.
*Einar.* Indeed, my mother, sir, has taught me this.
A witch, perhaps, as thou hast said, but not
A wrinkled hag; she 's white and red as milk
And blood; her name is Health, and comes as thou
Of ancient northern stock.
*Hakon.* Thine hour has come!
*Einar.* Not yet, my lord! But twenty winters crown
My head. Thou 'dst come to want, my noble Jarl,
If thou didst slaughter Norway's sturdy youth.
*Hakon.* Thou wretch! How nearly thou hadst slaughtered me!
*Einar.* By Odin, aye, by Norway's Freia, no!
I only wished to sever crest from helm;
No more I swear.
*Hakon.* And for thy practice, boy,
Thou choosest as thy target Hakon's head?
*Einar.* His crest, my master, only Hakon's crest.
To frighten thee did please me, for they say
That Hakon never flinches, hence I struck
The feather from thy helm. That wound may soon
Be healed, and cost at most a cockrel's tail.
For quittance, sir, pray hold within thy hand
This coin, and if my arrow fails the mark
Or wounds thy finger, shame me, call me woman,
Or hang me to the nearest tree.
*Hakon.* I trust
Thee, boy. Thine eye speaks true. In yonder birch
Thou seest a blemish, small and black, i' the bark;
Aim well, and if thine arrow squarely hits
The mark, thou 'st spoken true.
*Einar.* [*Aims and shoots.*] It 's done, my lord.
*Hakon.* A splendid marksman! Constantly I 'll have
Thee at my side. 'T was fortunate I met
Thee here. The rumor goes throughout the state
About a lad, who far excels with bow
And arrow. I have summoned him to Hlade.

When he arrives, he 'll see that also we
Have marksmen.
*Einar.* Let him come, and I 'll contest
His right to claim the laurel. What 's his name?
*Hakon.* They call him Einar Tambeskielver.
*Einar.* So?
Thus I am called. Ha! Let him come. I feel
In all that I 'm his equal, even in name.
*Hakon.* What? Thou art Einar Tambeskielver?
*Einar.* Aye,
The *one.* But bring me quick the *other;* then
We 'll strive for mastery.
*Hakon.* Upon my word
Thou art a swift and merry lad. Hast come
To stay at Hakon's court? [*Takes him by the chin.*]
How young and strong
And handsome! How presumptuous! Well, I 've need
Of sturdy lads like thee. So thou wilt serve
At court with Hakon Jarl?
*Einar.* If I can serve
In this or that, 't will be a pleasure; but,
It seems that Norway 's peaceful, well-content,
And calmly dreams as doth an elder parent
I' the cozy corner by the fire.
*Hakon.* Not all
Is peaceful, thou must know. I stand in need
Of men, aye, faithful, trusty men. Today
I sail with ships to clear our western coast
Of a strong and dangerous enemy. Wilt thou,
My friend, accompany us, and stretch the bow
For our defence, and honor for thyself?
*Einar.* I gladly go, my lord. By Thrudvang's[43] Thor,
Thou hast an excellent bow, my Jarl! Inlaid
With gold and silver; mine thou seest is made
From toughened sinews of the bear, and wood, —
No more.

*Hakon.* [*Taking his bow from his shoulder, hands it to* EINAR.]
Take this, my friend, and keep it; 't is
A pledge of Hakon's friendship!
*Einar.* [*Tries the tightness of the string.*]
Ah! Too slack,
Too slack is Hakon's weapon. Take it, sir,
Again. Too heavy; much too weak! My own
Is far the better.
*Hakon.* Ha, thou haughty youth!
Disdainest thou my gift?
*Einar.* Thou hast a gift
Which I would not disdain, if offered me.
*Hakon.* What is it, pray?
*Einar.* Thou hast a daughter, sir;
A rosebud on a slender maid, is not, —
But later we will speak of that.
*Hakon.* And thou
Dost think —
*Einar.* That I deserve sweet Berglioth.
*Hakon.* Thy aim is fixed on high and distant goals.
*Einar.* A skilful archer seeks a lofty aim.
*Thou* knowest my arrow reaches distant goals;
The eye of love hath also sent abroad
Its darts.
*Hakon.* And is the archer wounded?
*Einar.* That,
He 'll tell thee when he 's killed a goodly share
Of all thine enemies. Aboard, my lord!
*Hakon.* Art ready, boy, so soon?
*Einar.* [*Strikes his quiver.*] My chattels, sir,
I bear upon my back. To sea, my lord!
*Hakon.* A brave and fiery youth! My heart goes out
To thee as if thou wert a woman, lad.
*Einar.* My lord, of all ambitions, that is last! [*Exeunt.*

## Scene IV

### *A Peasant's House*

Orm, with his bride, Gudrun, seated at the head of the table, Bergthor next her. On the other side Astrid with her betrothed, Thorvald. Other peasants.

*Bergthor.* Be merry, children! Let the horns go round!
No stinting of the wine though dear with age.
Long since, the day Gunlöde stood my bride,
I placed this wine within the cellar, swore
An oath that it should not be touched, before
I solemnized my eldest daughter's marriage.
You see I kept my oath. My later years
Are filled with joy. A goodly wench, my friends;
Just nine months younger than the wine; thus long
I waited ere Gunlöde bore the child.
I well remember when I saw thee first;
Thou madest me angry, child, I nearly cursed thee;
And then thy mother, how I chided her.
'Woman'! I cried, 'what pranks are these? What need
Have I of daughters? Get me sons, whom I
Can teach the arts of war.' Therewith I threw
The wench upon the bed.

*Orm.* And yet in time
Thou camest to love the child.

*Bergthor.* I can't say how
It was, but as she grew, she crawled and whisked
About, now here, now there, and then when girls
Are fifteen, sixteen years of age, — well then,
Somehow you have to like them, aye or no;
It seems you 're forced.

*Orm.* Old age is happy here
Tonight. Come Thorvald, fill the horns anew!
Have all forgotten how to drink?

*Thorvald.* Forgot
To drink! How now my lad! Forgot to drink!
I feel like Fiölnir, I, the king who drowned

Himself in a keg o' wine.
*Bergthor.* Hush, children, hush!
What noise without?
*Thorvald.* More friends, more guests to the feast!

[*Stein and a crowd of armed slaves enter.*]

*Thorvald.* What men or slaves are these? Your errand, sirs?
*Stein.* We 're slaves of Hakon Jarl and bring withal
His latest orders.
*Orm.* Hakon then has learned
Of our assembling here and so has sent
Us word. We 'll hear his wish; speak freely, sir.
*Stein.* That such a numerous throng was gathered here
The Jarl did not suspect, although he knew
About the nuptial feast.
*Orm.* Thine errand, sir,
Speak out!
*Stein.* In short the Jarl has sent us here
To greet thee, Orm, with friendliness. He 's well
Acquainted with thee, knows thou art a man,
Obedient to thy master, always true.
The Jarl has seen thy bride; she stirred his heart,
He cannot live without her. Long he strove
Against his craving, but he could not bear
To think, that that which he desired, yea longed
To have, a subject now possessed. He hopes
That thou wilt still this yearning of his heart
And freely yield to him thy bride.
*Bergthor.* [*Rising.*] How 's that?
*Orm.* You come to steal my bride?
*Stein.* Nay, not to steal,
If thou, as Hakon thinks thou wilt, dost yield
Her willingly. Thou 'lt only need to wait
A little time, he 'll send thy Gudrun back,
Along with costly presents, jewels and gold.
*Orm.* Depraved thralls, you dare pronounce those words?
And such demand, such offer, Hakon dares
Propose to Norsemen who are proud and free?

*Stein.* There 's many a bridegroom proud and free as thou,
Has deemed a like proposal fortunate.
We hoped, except a few especial friends,
To find thee here alone. Two reasons urged
The haste with which we bring the message: first,
The Jarl's departure on his ship from Hlade:
And next, the haste which thou dost show to wed
Thy bride; as thou must see, emphatic means
Must here be used to check this haste. He left
Distinct commands that we should bring the maid
To Hlade, guard her there until he comes.
Condemn the Jarl? — No, none of us would dare
Presume as much. He lives too high for censure. [*Great uproar.*]

*Bergthor.* This goes too far. Audacious slaves! Begone,
Away, I say!

*Thorvald.* [*Seizing a drinking horn.*]
Salute the Jarl and say:
Thorvald has drunk to Hakon's funeral feast.

[*Several voices.*] Away with Hakon's slaves! Away, away!

*Stein.* [*To the other thralls.*]
To arms, my lads!

*Thorvald.* Ye dare to measure arms?

*All.* Kill them, kill them!

*Bergthor.* This hammer, sirs, is forged
Of toughest iron; where it strikes it cuts
A bloody swath.

*Stein.* Strike hard, my lads, strike hard!

*The Peasants.* Kill off the brood of vipers! Mow them down!

Battle. After some opposition the slaves of HAKON flee; the peasants follow them. GUDRUN, who has fainted, is surrounded by the women present, who try to bring her to herself again.

*Astrid.* My sister! Dearest Gudrun, open, sweet,
Those eyes! Come back to life. The foe has gone.
Look! Look you through the window where they flee!

[*The men return.* ORM, *who becomes aware of* GUDRUN'S *condition, throws himself at her feet.*]

*Orm.* My bride, my Gudrun, bring me back my bride!
Why stand ye there and weep, ye women? Where
O where is now your art? My bride, my bride!
*Thorvald.* By that All-father Odin, seated high
On his exalted throne, I lift my sword
Besmeared with blood of slaves, with blood that streamed
From Hakon's friends. I hereby swear an oath
Of vengeance! Yes, by all the Aesir, all
That 's holy, not to rest before I mix
With Hakon's blood, the blood of slaves, and thus
Revenge the shame he thought to bring my brother.
*Bergthor.* Although I am old and wrinkled, bent with years,
I swear by the hammer's molten tooth, that far
And wide I 'll seek revenge for this disgrace.
He wished to have us forge a crown, — aye, first
Let 's forge the man! I am the oldest here,
The father of the girl! Look, where she lies,
A hapless maid, a drooping flower, death pale,
Within her lover's arms. Come, peasants, come,
Surround me, swear upon this hammer, swear,
That Hakon Jarl, the evil one, must die!
*Orm.* My Gudrun, life again looks through thine eye!
*All the Peasants.* [*About the hammer.*]
'T is sworn! The tyrant, Hakon Jarl, must die!

## ACT III

### SCENE I

**The Island Moster**

[*Enter* JOSTEIN, CARLSHOVED *and* GRIB.]

*Grib.* As I have told you, worthy lords, the Earl
Has landed here at Moster, and lies with all
His crew in the woods, behind the isle.
*Carlshoved.* And chanced
There no encounter 'twixt the two when Olaf

Went out to bring his ships to harbor? Strange!
We hourly wait the king.
*Grib.* The night was dark
And helped the shrewdness of the Earl.
*Jostein.* And so
The doughty Jarl is all prepared to greet
The king when he attempts to land? A large
And worthy island this, for such a duel.
*Grib.* A greeting is in store for Olaf; yet
This duel needs no large and splendid isle.
An open place is not what Hakon seeks;
He wants a dark and gloomy forest, such
As here we find on either side.
*Carlshoved.* Explain
Thyself, nor hide the meaning of thy words.
*Grib.* A holy ordering of the gods has changed
My master's lie to truth; which truth in turn
Has changed their common plans.
*Jostein.* Audacious slave!
Dost dare to utter thoughts as bold as these?
*Grib.* I speak as thou wilt speak, I trust, when thou
Shalt know how matters stand.
*Carlshoved.* Speak plainly then!
*Grib.* Then know: The Jarl had scarcely put to sea
Before a hasty fishing smack o'ertook him,
When late he crossed the bay. It brought the news
That Throndhiem's peasants were in arms, conspired
Against the Jarl, because of a certain maid
His passions craved. The strength with which their wrath
Broke forth betokened that the smoldering coals
Had long been fanned. So what was he to do?
The Jarl, you know, decides with over-haste.
A moment's thought and he announced: to crush
The powerful hostile prince, would aid his cause
Far more, than war against the farmer-folk.
To fight the king, he meant, would strongly aid
His martial fame, and fright the people most.

But out upon the deep, he learned from spies,
That Olaf's fleet outnumbered far the rumor
Reported him at Hlade. What was he
To do? He sought this island, where he found
My lord, his other-self. The Jarl is not
Dissuaded from his will with ease. When one
Scheme fails, another takes its place. My lord's
Proposal was agreed upon. "The need
Compels me! the cause concerns the highest gods."
Such were his words, and yet the cause concerns
Himself as much, to seize the unbidden guest
That grapples at his throat. The Jarl's distress
Is sore; if once 't is known how matters stand,
That Olaf lives, his presence here, then love,
The ancient love for Norway's kingly blood,
Combined with hate toward Hakon's guilt, would make
The danger for the Jarl more dangerous still.
What happened then? He told his men to rear
The tents; they little guess the truth, and think
That they are robbers whom they seek.

*Jostein.* And what
Are now his plans?

*Grib.* Through many a sleepless night
Upon my bed of straw, with tear-stained eyes,
I 've asked the gods to show me why they 've bound
My young ambitious life in thralldom chains.
Thanks be to these all-wise and precious gods!
For otherwise, too late, had Thorer's schemes
Been known; for otherwise was Olaf lost,
Aye, steeped in 's noble, kingly blood.

*Jostein.* Conceal
No more the substance of thy words; speak out!

*Grib.* I heard it; I was present; I 'm his slave,
A wretched, sordid slave, who must attend
His master, quite unnoticed, like the trail
That fastens to his cloak. And, briefly, what
Are his intentions? Under friendship's guise,

To yonder wood must Olaf be enticed,
And there entrapped and — stabbed! In a hut, near by,
The Jarl awaits my lord with Olaf's head.
In Rogaland[44] the people still are true,
And thither they proceed to raise a force
With which to stem the Irish, should they dare
To land and try to avenge King Olaf's death.
*Jostein.* All this thou 'st heard?
*Grib.* I swear by pious Baldur,[45]
As true as I am blameless, innocent.
*Jostein.* And we are pledged to lend a helping hand?
*Carlshoved.* And we are pledged to further such a deed?
*Jostein.* Ha, Grib! I blush for shame before thee, I—
*Grib.* O never mind, my lord; when one has reached
That point where he 's ashamed, he feels the sting
And need not be ashamed. And how surmise
That Hakon Jarl was base enough to stoop
To such a deed? His eyes hurl forth a light
As if he were a god. A simple glance
Commands; he spoke and you obeyed. 'T is great
To fight for Hakon, feel within your breast:
I helped to place this man upon the throne.
Were 't not such thoughts that spurred you on?
*Jostein.* We 'll wrench
Him from his throne!
*Carlshoved.* As sure as Olaf lives,
That noble hero, Astrid's son, so sure,
The Jarl must die!
*Grib.* I see your hearts are true.
But hush! The ship has all but touched the shore.
Look, yonder lands the king. Dost see his boat?
Whate'er is done must now be done with haste;
As soon as Olaf comes — and you 're alone —
Reveal to him the plot. My lord delays
With Hakon in the woods; if Olaf hastes
To land his men, he 'll cage them both with ease.
Whate'er may chance the power belongs to Olaf.

List! Gentle tones are wafted from the ships.
How sweetly float upon the level sea
Those pious chants! Adieu; I haste to join
My master in the woods. Remember well
Your part.

*Jostein.* We 'll not forget.

*Carlshoved.* The ship's at rest.
And see, the king descends, and now his men,
And priests. And look, he spreads to all the winds
The scarlet flag with cross of purest white.

*Jostein.* The scarlet groundwork stands for heroism,
The cross for Christian peace and innocence.
They now approach. Come let us walk aside. [*Exeunt.*

OLAF enters with the large banner in his hand; he is followed by his warriors and priests. The latter sing:

*Coeli Deus sanctissime,*
*Qui lucidas mundi plagas*
*Candore pingis igneo,*
*Augens decoro lumine!*

*Infunde nunc, piissime!*
*Donum perennis gratiae,*
*Fraudis novae ne casibus*
*Nos error atterat vetus.*

*Expelle noctem cordium!*
*Absterge sordes mentium!*
*Resolve culpae vinculum!*
*Everte moles criminum!*

*O tu, sole serenior,*
*Et balsamo suavior,*
*Veni, veni. rex optime,*
*Pater immensae gloriae!*[1]

*Olaf.* [*Raises the banner and plants it firmly in the soil.*][46]
And thus I plant the Christian banner, deep

[1] The following is a translation of the Danish of these stanzas:

The dark of night shall disappear,
O Lord of Heaven, when thou art near.
The inky clouds shall pass away
All hail, Redeemer, hail thy day.

The icy North shall soon be stirred
By loving shafts from thine own word.
Thy servant, strong in heaven's might,
Shall put the heathen gods to flight.

In Norway's soil. Through every rift among
Her rocks, e'en as the native fir, its roots
Shall creep; and it shall blossom forth and bear
Its fruit, yea, sevenfold refreshing fruit.
With tears of yearning and repentence shall
Its roots be watered; peaceful sighs shall come
Like gentle breaths of wind, to mellow, sweeten
The juice that overfills the cup. As birds
Send up to heaven their song, the church's voice
Shall fill the air with praise, and as an oak,
A hundred winters old, this tree shall spread
Abroad its branches over all the land.
Within its shelter, friendship, gentleness
And love shall dwell, and from its shielding trunk,
Shall gaze devoutly toward the setting sun.
And in its pure and holy bark the Kings
Of Norway's realm shall proudly carve their names.
And round about, the flowers of innocence
Shall stand on guard, sweet angels sent from heaven,
And keep away the spectres of the night.
Then one-eyed Odin, driven from place to place,
Shall seek the deserts, and the naked rocks
And there shall vainly strive to repossess
His former power. There he will howl as doth
A wounded wolf; the tree shall gently stir
Its leaves like angel wings and waft away
Those piercing sounds, lest they should terrify
The tender babes, so newly born to Christ.

*The Chorus.* Amen!

*Olaf.* Thanks brothers, thanks, for strengthening thus my words.

Do ye recall the island Stord which late
We passed? There Hakon Athelstein, the Good,[47]
My great forerunner, dwelt, when he was called
To leave the banquet for the battle field,
And there to die the hero's death. O Hakon!
My noble, gentle Hakon, best of kin!

A flower too early blown, thou wilted, chilled
By treacherous frosts; thy root was much too frail
To penetrate this icy northern soil;
But thou didst leave a tender seedling here,
For which may heaven become thy blessed home.
There thou art safe against the heathen might
Which thou couldst not subdue; which made thee eat
The horse's flesh, and forced thy lips,—that loved
Alone the church's holy cup,—to touch
The heathen sacrificial bowl. The times
Were yet unripe, but now thy smile from heaven
Shall light the way to follow in thy steps.

*The Chorus.* Amen!

*Olaf.* Thanks, brothers, thanks! And now retrace your steps
To rest your weary bodies from the voyage.
The men have pitched the tents, while ye with song
Have consecrated, blest the land. Now go,
My gentle brothers, go, in heaven's name.

[*Exit* CHORUS; OLAF *remains with his warriors.*

CARLSHOVED *and* JOSTEIN *enter.*

*Olaf.* My noblest kin, my honest friends, in this
My duty, newly found, can I depend
On you?

*Jostein.* My king!

*Carlshoved.* King Olaf!

*Olaf.* What! How now!

*Jostein.* [*Kneels.*] Strike off our heads!

*Carlshoved.* [*Kneels.*] Yea, take them; they are thine.

*Olaf.* What means this strange behavior?

*Jostein.* Treachery!
We have deceived thee.

*Carlshoved.* Basely, yea, deceived thee.

*Olaf.* Impossible. You say, deceived me? How?
Is all this mere invention?. mere device
To lead me into Hakon's snare?

*Carlshoved.* Spare all
Thy fears, my lord.

*Olaf.* I fear not hell itself,
Far less the Jarl. Stand up! Wherefore this kneeling?
If ye have sinned, then kneel before high God,
And tremble, quake, at heaven's avenging hand.
*Carlshoved.* My noble Olaf! Thorer Klake lied;
Yet every word he uttered was the truth.
*Jostein.* What first was mere invention, Hakon's acts
Of tyranny have changed to truth.
*Olaf.* Is 't true
The land revolts against him?
*Carlshoved.* Aye, my lord.
*Olaf.* And Hakon?
*Jostein.* He is here.
*Olaf.* Here?
*Carlshoved.* With a force
Not half as strong as thine, my lord.
*Olaf.* Dost know
His plans?
*Jostein.* To play his tricks beneath the board
Where openly he failed. Our Thorer proves
Himself a traitor; secret plans are laid
To lure thee 'twixt those shady firs, and there
Administer thy mortal wound.
*Olaf.* Is Hakon
I' the woods? Doth Thorer come alone? How large
A force is Hakon's?
*Jostein.* Not so large as thine.
The utmost silence hovers round the scheme,
For Hakon fears his own sworn warriors, more
Than any foreign foe. The people must
Not know thy presence here, for that might cause
A festering sore to break. Earl Hakon hides
Within a peasant's hut; thou 'lt meet with Thorer
In yonder woods. To make the seizure sure
Let all thy warriors follow thee, for then
Thou 'rt strong enough to cope with Hakon's force.
*Olaf.* What credence should be giv'n such doubtful words?
How know, that here ye speak the truth, since ye

But now confessed your treachery?
*Jostein.* That we
Confessed, should prove our innocence. The Jarl
Expressed the wish to meet thee openly
And bade us follow Thorer Klake, help
Detain thee here till he himself should come.
To seek adventure on the battle field
Is northern morals. Hakon was our lord.
His shrewdness his deception did not fail
Cunningly to ensnare our youth. Thou art
Our kin, but once we saw in thee a mere
Enthusiast, disturber of the peace.
We came. But since, the tide of things has changed,
And with it Hakon's plan. When this we learned
We quickly bore the intelligence to thee,
For silence meant betrayal. Former acts,
Adherence to a villain, these deserve
Just punishment; I offered thee my head,—
Take it, but ne'er mistrust me.
*Olaf.* Valiant lad,
Retain thy head; thou needst it more than I.
*Carlshoved.* Our king!
*Jostein.* Then trust my word and follow me;
Or quickly leave with all thy ships. But see,
Is not that Thorer slinking through the trees
With Grib?
*Olaf.* My men, in part have reached the land;
I 'll go instruct them, safely to invest
The isle, and then 't will be a simple task
To capture Hakon and his brood. [*To his men*] Attend
Me through the forest; draw your swords, and keep
Yourselves in readiness to strike a blow. [*Exeunt.*

[THORER KLAKE *and* GRIB *enter hastily from the other side, the first with a basket and a dagger in his hand.*]

*Thorer.* See, there he went, accompanied by his troops.
They go to rest in Norway's summer grass.
Stop, Olaf! hurry not so fast! It comes,

The long last rest, before thou dreamest of it.
Now, Grib, dost understand what I have said?
*Grib.* Yea, every word, my noble lord, full well.
*Thorer.* Thou 'lt run and plunge the dagger in his breast
The while we sit and talk.
*Grib.* Aye, valiant lord!
*Thorer.* And when he falls, cut off his head, and place
It in this basket; follow me in haste
To where the Jarl awaits us, at the hut,
And he will grant thee freedom, Grib, and bind
A glaive about thy loins.
*Grib.* My honest lord!
*Thorer.* Conceive the honor thou 'lt enjoy, my Grib!
Think on it, Olaf's executioner;
Aye, he who wished to hurl the gods from Valhal,
Him, thou didst slay; and after many years,
In olden legend, one will find thy name,
And read, "This gallant deed hath Grib attained."
*Grib.* I feel an ardent longing, noble lord!
Full many a day I 've dreamed of such a stroke,
That might extract me from my slavish state.
*Thorer.* I know it, Grib; 't will soon be realized.
Come, look, dost see this dagger, keenly ground?
It shines as bright as do the stars from out
A quiet sea; look, feel the point! Is 't sharp?
*Grib.* A most surpassing knife.
*Thorer.* And yet there 's more;
Thou seest but half of its peculiar charm;
For—notice here upon the blade this groove
Which reaches toward the point?
*Grib.* Aye, aye, my lord!
*Thorer.* [*Smiles cunningly.*]
It may be small, and yet it points the way
To Helheim,[48] Grib! [*Looks about.*] There 's no one here?
*Grib.* No, none;
'T was but a hungry raven, calling, perched
Yonder lofty rock.

*Thorer.* In search for prey.
Well, then, this groove, which reaches from the hilt,—
Thou seest the hilt is hollow, and this spring—
Dost understand me?
*Grib.* No, my lord!
*Thorer.* Ah, true!
Our clumsy north is stranger still, to things
So subtile, overnice. I bought this knife
In Italy; I thought, as now proves true,
Who knows whereto it may be used?
*Grib.* Just so.
*Thorer.* And now my Grib, hast thou not often known
A wounded warrior, who has seen death's door,
And still returned to life, full strong and hale?
*Grib.* Yea, often lord.
*Thorer.* Therefore, a dagger thrust
That must be sure,—thou seest thyself, one can't
Depend alone upon the strength the arm
Affords.
*Grib.* I see not yet,—an arm of power—
*Thorer.* What power? Alas, how frail is human power!
But notice now; this groove contains a fluid,
Which mingles with the blood and curdles it.
*Grib.* Ha, now I comprehend thy words, it 's poison!
*Thorer.* Scream not so loud. Here, take the dagger, Grib.
And handle it with care, judiciously;
Thou 'rt not accustomed, Grib, to such a tool.
*Grib.* [*Cradles the weapon in his hand.*]
My lord! I feel a strange desire. Dost know
Whereto?
*Thorer.* No, Grib. Thine eye is all aflame.
What is 't?
*Grib.* To plunge this knife into thy breast.
*Thorer.* Thy wits, thy sense—
*Grib.* Be calm, my lord, conceive
I 'm only joking.
*Thorer.* Ah, but such a joke!

*Grib.* Dost mean my joke is quite too coarse?
*Thorer.* Too coarse,
My Grib; and there 's no time for joking now.
*Grib.* Let 's then be serious. Hark, the raven screams
Anew. Come! take thy booty. [*Strikes the dagger into* THORER'S *breast.*]
*Thorer.* [*Falling.*] Curse thee slave;
Thou 'st pierced my heart!
*Grib.* Ah no! What is it thou
Dost call thy heart? That icy lump of flesh
That lies within thy breast deserves not such
An honored name. It never felt for others,
How feels it then this thrust? Impossible!
*Thorer.* Thou traitor!
*Grib.* Thou hast named thine own foul name.
*Thorer.* Thou savest the truth! [*Dies.*
*Grib.* Thou shouldst have recognized
Thy weakness sooner; now it 's quite too late. [*Looks at him.*]
Now there he lies bespattered with his blood.
Where now are all thy shrewdness, plots, intrigues?
Why not invent some clever means by which
To still the blood? How stupid, silent, now,
He lies, his face turned heavenward, and all
His life long subtle craft doth not suffice
To save his spirit from a writhing hell.

[*Enter* OLAF, CARLSHOVED, JOSTEIN *and followers.*]

*Olaf.* [*His sword drawn; to* GRIB.]
Where is thy master, slave?
*Grib.* [*Pointing to the corpse.*] Sir, there he lies.
*Olaf.* What? Thorer bleeding, Thorer Klake dead?
*Grib.* The waves of dark Elivagar[19] now bear
Him down toward Niflheim.
*Olaf.* Who hath slain him?
*Grib.* Sir,
His villainy,—he slew himself.
*Olaf.* Explain!

*Grib.* His great persuasive powers were spent to have
Me plunge this dagger in thy breast. Thor knows
Wherefore; he must have loathed to do the deed
Himself.
*Olaf.* What more? Say on.
*Grib.* He handed me
This dagger well supplied with poison, which
I should have buried deep in Olaf's heart—
I erred and plunged it into Thorer's breast.
Now stubbornly he lies upon the ground
Without one word. Before, his oily tongue
Ran wild, his fawning looks were everywhere,
Unsteady, bold. The sense of his eye hath flown;
How stupid, drowsy, filled with emptiness!
My lord, thou 'lt scarce believe how quickly, how
Completely he has changed his wonted nature.
*Olaf.* Thou noble thrall!
*Grib.* If Thorer lived, he 'd say
I speak the truth. He promised he would make
Me free, that I might bear a sword and shield,
And follow Hakon in his wars, and drink
The wine at table, in the king's own hall,
Perchance I did my duty well; but sir,
It seemed too dear to purchase Hakon's wine
With Olaf's blood.
*Olaf.* High-minded swain! Perhaps
Thou 'st rather follow Olaf, fight for him,
Make him thy king, and sit as mark of friendship,
Among his greatest men?
*Grib.* [*Deeply touched.*] My king, now melts
My pride through love. And dost thou grant me this?
The hour has come at last when I may rend
My thralldom chains? O, sir, forgive, forgive
My childish tears.
*Olaf* . The Jarl had promised thee
Thy freedom.
*Grib.* Ah, but such a freedom, such
A freedom, sir. Wherein 's the gain, to buy

The body's freedom for the soul's; to lose
The name of slave, and truly be a slave.
*Olaf.* Thou Christian heathen, come; give me thy hand;
Now what's thy name?
*Grib.* Grib was my thralldom name.
*Olaf.* Henceforth let Griffin be thy name, and let
A powerful griffin,[50] striking to the earth
A venomous snake, be drawn in deepest hues
Upon thy shield.
*Griffin.* Ha, sir; I see, I see!
The snake is Thorer Klake. Excellent,
By Odin! Olaf, thy reward is kingly.
*Olaf.* Call not Odin! His power is impotent;
Behold his spirit in his worshippers!
Where now is Hakon?
*Griffin.* Yonder in the woods,
In hiding with his thrall, sir. There he waits
For Thorer and thy head. But let me take
My master's head and place it in the basket
Then thou shalt bring the Jarl false Thorer's head,
Instead of Thorer thine.
*Olaf.* No, Griffin! Death
Is death. [*To his men.*] Go now and bury Thorer's corpse.
*Griffin.* Behind the nettles in the ditch!
*Olaf.* Lay him
Beneath yon elder bush that it may shower
Its white funereal petals on his grave.—
Be not so cruel, Griffin; hate should cease
At death.
*Griffin.* My lord, be pleased to tell me what
Is right, and thou shalt see me grow in grace.
*Olaf.* Then follow me in silence to the Jarl.
*Griffin.* This way, my noble king.

## Scene II

*A Byplace in the Woods, at a Peasant's Hut*

Hakon Jarl *and* Karker

*Hakon.* Hast done thine errand as I bade thee?

*Karker.* Aye, my lord. I told them on board the ships that thou wert gone to the woods to seek a cool breath among the trees, because at noon it is so hot on the salt sea; the reason being that the sun shines with so much glimmer on the water, and then from the water up again. This is hard to endure, for on the sea there are always two suns, that is to say, one in the sky and one on the sea. On the land one is plagued by one sun alone and hence thou hadst gone up on the land.

*Hakon.* And that I would dine here, this thou hast also told them?

*Karker.* My lord, of course I did. When do I forget a meal and what goes with the meal? That is the best of all in this world; though I fancy that in the other world drinking has its place. Of course I told them: the Jarl will breakfast yonder. On the water the boat jostles up and down and the food is liable to take the wrong channel. What 's the use of that?

*Hakon.* Right, my lad, right. Thou art a famous fellow. Go now and help the cook. Leave me alone, Karker. When Thorer comes, or Thorer's slave, bid him enter immediately.

*Karker.* Good, my lord! It shall all be done. [*Exit.*

*Hakon.* I would I had a host of men like this,
I 'd then be safe no matter where I went.
A dog is not as true, as faithful; then
Besides, a man can talk. A weapon, tool,
Quite indispensable! I 'd not exchange
Him for the strongest sword. [*Sits down.*] The other men,
With keener eye, and wiser speech, one can't
Confide in them. Though Thorer—Thorer! Ha!
Hast greeted Olaf yet? Hast sent him forth
To meet his gods up yonder in the sky?

[*Rests his head in his hands and muses.*

That scheme was never mine; it came from Thorer.
'T is he must answer Valhal; he, not I.
But Odin bears no wrath. Shall not this craze
Be checked, whose direst threats would hurl the gods
Down from their olden seats? 'T is not alone
My kingly power that Olaf craves, but more:
Valfaudur's.[51] So, let Olaf fall!' The storm
Must cease. The time has come, the time has come.
It whitens fast, my hair! But, faded locks,
Have patience, patience; soon ye 'll turn to gold.
The roguish maidens mocked me formerly
Because my hair was black instead of gold.
Have patience, children! Gold? A golden gold
My hair shall be when gilded by the crown.
Who comes, who comes? Ha, surely, Thorer Klake.
He promised me to bring me Olaf's head!
Mine eyes refuse to look upon the sight.

[*Remains seated in the former position.* OLAF TRYGVESON *enters, wrapped in his cloak, and wearing a broad hat.*]

*Hakon.* [*Without turning toward him.*]
My honest, valiant Thorer, hast come at last?
Have all things prospered, even as thou planned,
And bringest thou what was promised,—answer, Thorer!

*Olaf.* It all has happened as it should, my lord.
But pardon Thorer, sir, that he himself
Does not bring Olaf's head. He found it hard
To do. Thor knows, he felt a sort of loathing
To bear the head himself, and hence sent me.

*Hakon.* 'T is well! Then go and hide it deeply, deep,
Dost hear me? in the bosom of the earth.
I 'll not behold it. It comes to me in dreams.
Go bury it and tell thy master, slave,
To hasten hither.

*Olaf.* Thorer Klake sleeps.

*Hakon.* What, sleeps?

*Olaf.* A noon-day sleep; he stiffly stretched
Himself beneath a shady elder-tree.

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*Hakon.* Then wake him, quick! [*Aside*] Asleep? And after such
A deed? Ah, Thorer, I admire thee! Ha!
The strangest courage, thine! [*Aloud*] Go, wake him, slave!
*Olaf.* But first will thou not gaze on Olaf's head?
*Hakon.* No, no, I 've told thee! No!
*Olaf.* My lord, dost think
Perhaps it hath an ugly, hideous look?
Not so, Jarl Hakon. Olaf's head is sound
As any head in Norway.
*Hakon.* Slave, begone!
*Olaf.* I never heard the like! I thought the Jarl
A peerless man, surpassing other men;
A dead, a pale, a cold dissevered head?
How thou hadst trembled, hadst thou found it live
Upon its body.
*Hakon.* Slave, thou darest to speak—
Where is it then?
*Olaf.* [*Takes off his hat and throws the cloak aside.*]
Upon my shoulders, sir!
Forgive me that I bring it thus; it seemed
The most convenient way.
*Hakon.* [*Drawing his sword.*] Ha, traitor! Olaf?
Ha, treason, treason!
*Olaf.* Spare thy courage, sir.
Risk not a tilt with Olaf, while he keeps
His head in place unharmed. Remember this:
Thy old and feeble brain alone is matched
Against a headless spectre.
*Hakon.* Death and hell! [*Rushes upon Olaf.*
*Olaf.* [*Strikes the sword from* HAKON'S *hand, and speaks with thunderous tones.*]
Peace, peace, I say! Put up thy sword. My men
Surround the hut; my ships outbalance thine.
I come to claim this land by honest strife.
Thyself hast lured me here by false intrigues.
Thou standest there, a thrall, contemptuous,

Entangled in thy self-laid snare. I 'll not
Employ such paltry means as merest chance
Hath offered me. Not so, my Hakon Jarl!
Upon the battle field I 'll boldly meet thee.
Thou seest thy schemes have failed. Thy Thorer stands
Before high heaven's Judge. 'T were easy now
To seize thee; easier still to end thy life.
But I defend the Christian faith, and scorn
The like inglorious display. So choose
Betwixt a twofold choice; remain as Jarl
At Hlade, as thou art, and give thy oath
Of loyalty,—well then begone! And bear
In mind that wheresoe'er we meet again,
It 's blood, my Jarl! Blood! Thou or I must die!

*Hakon.* [*Proudly and calmly.*]

I choose the latter, Olaf, aye, the latter.
Thou callest me villain,—slave? This makes me smile.
One reads in this thine utter youth, Sir Olaf.
Thy years betray themselves in flippancy,
In arrogance. Look deep into mine eyes,
Yea, scan my forehead, Olaf; tell me: sawest
Thou ever such in slaves? Think you, perchance,
That cowardice, deceitfulness have carved
This wrinkled brow? I lured thee on? And why?
I knew thou needest but a sign to tempt
Thee toward the prize. Deep in thy haughtly soul
Thou lovest more the ties of blood, that bound
Thee to a royal race extinct, than all
The scores of far-famed deeds of Hakon Jarl.
Thou 'st waited long to bring confusion and
Disturb an old man's peace. That I desired
To end the feud, as soon as possible,
Does this astonish thee? That I beguiled
A frenzied visionary, one who scorns
The highest gods, does this astonish thee?
Does it astonish thee, that I approved
My Thorer's scheme, when hostile fate made threats

To overthrow—not Hakon Jarl alone—
But Valhal's gods?
*Olaf.* But sir! Hast thou forgot—
Ah Hakon, Hakon,—quite forgot, that thou
Thyself was once a Christian, once baptized
By Bishop Popo?[52]—that thou brokest thy vow?
How many oaths since then hast thou infringed?
*Hakon.* Cursed be the moments, sir, of which thou speakst.
When blinded by a coaxing monk, I let
Myself be fooled by paltry tricks; he wore
A red-hot iron glove, when first his hand
Was daubed with witches' salve.[53]
*Olaf.* Poor, blinded, wretch!
I pity, sir, those locks of silver gray.
*Hakon.* Ha, spare thy pity, Olaf! Look, behold!
Thou seest in me the last gleam, the last spark,
Of olden Northern strength, heroic life;
But this, proud youth, but this thou 'lt never quench
With those thy sickly fever-dreams. I know
Too well, it is the Christian's wont to mend
Our morals, sympathize, forsooth convert us;
'T is ours to deeply hate, despise you, aye,
To ponder on your ruin and your death,
As those who mock our gods, our northern ways.
This Hakon does and therein lies his sin,
His villainy. I swear by Thor, by Odin,
Thou 'lt never quench proud Norway's heroism,
With pious, dreamy, mistiness.[54]
*Olaf.* Enough!
We part, and woe to thee when next we meet.
*Hakon.* Aye, woe to me, unless I crush thee then.
*Olaf.* Our God shall smite thee with His deadly flame.
*Hakon.* Thor's hammer[55] first shall fall and split the cross.

## ACT IV

### SCENE I

**Hlade**

HAKON JARL. *A Messenger.*

*Hakon.* Now tell me all, and speak without reserve
Or fear. How goes it? Are the peasants gathering?
*Messenger.* My lord! Exasperation drives them on.
In four directions from his farmstead, Orm
Hath sent his messengers of war and prayed
That each should arm himself against thy life.
At Skaerdingstad[56] the tidings came to Haldor,
And he in turn has further spread the call.
To him has Sigurd strongly joined himself,
Thy former mistress's beauteous Bryniolf's husband,
As also Alf and Skialm from Rimol, who
Have come to avenge their sister Thora's wrongs.
These two with Orm and Haldor lead the army.
They gather in the vale of Ork.
*Hakon.* I trust
Completely in my sturdy warrior lads.
With few well-armed, and brave war-hardened men,
A horde of untrained farmer folk can soon
Be put to flight.
*Messenger.* But, sir, their force is large,
Increases day by day; they 're strongly armed,
Exasperate—
*Hakon.* With momentary rage,
Which vanishes at sight of Hakon's sword.
Aught more? Has Olaf's fleet approached the shore?
*Messenger.* It has, my lord; he 's entered Throndhiem's fiord.
*Hakon.* In Throndhiem's fiord? Was not the entrance barred
By Erland?[57] Did my son not meet him there?
*Messenger.* Ah, yes, my lord!
*Hakon.* And why that sighing? Speak!

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*Messenger.* At daybreak, sir, King Olaf hove in sight,
With five long warships hung with shields; thy son
Was there with only three; the others lay
Deep in the cove. A fog lay on the sea
And Erland's signal failed to reach them. First
He thought, by happy chance, he 'd met his own;
Discovering soon the truth, he turned to flee,
But all too late. The King bore down upon him.
He took thy son for thee, for Hakon, bade
The oarsmen pull their ablest stroke. At length,
His ships being driven upon the rocks, thy Erland,
With all his men, leaped boldly overboard.
With only three small ships, each poorly manned,
Opposed by five, all filled with steel-clad men,
The fight was too uneven, sir. He swam
Beneath the waves, and thuswise sought to reach
The shore. But Olaf watched him close. He saw
The shining coat of mail, the copper shield
Whose beauty far outgleamed the rest. And all
The while he thought 't was thou and cried: "Ah Hakon!
This time thou 'lt not escape thy doom! Recall
When last we spoke! We swore that blood should flow!"
With this, King Olaf seized an oar, and hurled,—
Oh Sir, Sir Hakon, spare me further words
And spare thyself—

*Hakon.* Nay speak, he seized an oar
And hurled—

*Messenger.* And smote thy son upon the brow
With such a force the skull did burst and poured
Its contents in the sea.

*Hakon.* [*Concealing his pain.*] Hast more to tell?

*Messenger.* The King was vexed when told he 'd struck thy son,
Not thee. His warriors butchered many men,
And yet he pardoned some. From these he learned
About the peasant forces, how they stand,
Their hate toward thee.

*Hakon.* Aught more?
*Messenger.* No more, my liege.
*Hakon.* Then go. [*Exit Messenger.*] So, Olaf, thou wert vexed when told
'T was not the Jarl thou 'dst killed. Thou never hitst
A better mark. Yet him thou didst not touch.
Ah, no! My son, my Erland was not slain;
Him Aegir[58] took within his loving arms,
And bore aloft the spotless lad to Valhal.
But me, his aged father, him thou 'st touched,
A poisonous arrow burns within his heart.
Oh, Erland, Erland, Oh my son, my son!—
Thus moved; thou Hakon? Tears upon thy cheeks?
Long, long since last thou wept. Ah Hakon Jarl,
Thou 'rt getting old, thou weepest like a woman —
But he was dear to me; the light, the hope
Of my declining years; I saw in him
The heir of all my faith, and Norway's throne.
My dreams, my fondest dreams, where flit ye now?
[*He broods a moment, then terrified says:*
They gain upon us, drive us back! How now!
Do misty fogs envelop Valhal so?
Did Odin's golden throne e'er rust or lose
Its beams? Luxuriant Frigga, sleeps she now,
As does the birch in harvest time? Again
Has Loke stolen thy fruit, O Ydun?[59] Where,
Aye, where 's thy hammer, Thor? Where Asatyr,[60]
Thy powerful, death-dooming left hand? Pray tell,
Thou airy host, hast wrapped thyself in gloom
And followed Baldur down to deepest hell?[61]—
Up, Hakon Jarl! Thou art still the North's defense!
They call thee heathen, thee, for thou dost fight
For olden times. To arms, to victory!
Forgive your Hakon, ever holy gods,
That he has thought of self, forgetting you.
But hear me, hear me now; from this hour on
To you, eternally, belongs my life.

Thou fondest dream that hoped calm evening's sun
Might crown the evening of my day, before
It sank, is gone, aye, gone; a storm has broken
With rain and sleet; it wraps the sun in mists,
And ere the sky again is blue, the stars
Will shine on Hakon's grave. Ran[62] took my son,
My Erland; Erling still is left. But how
Can I believe this tender shoot will e'er
Defy these vicious times?—Then, Odin, hear
My oath, I swear by all those precious stones,
The stars that gild thy crown, by Auk-thor's wain,[63]
From this hour on I live for Valhal's gods.
If pride ensnared my thoughts, forgive, forgive,
Thou beauteous Saga,[64] it was thou who charmed me;
And Odin, if displeasure at my deeds
Hath vexed thy brow, require thy offering, ask
Whate'er thou wilt and thou shalt have thy wish.

STEIN *enters bearing a golden horn.*

*Hakon.* What hast thou there?

*Stein.* Booty, sir, taken from the enemy. Thou knowest that Olaf sent a group of workmen to erect in the woods near the strand, a house, a church they call it, for their new gods. Thou didst command, as just, to go and hinder them in this work. We did as thou didst bid. But before we came, Olaf's men, by digging deep into the earth, had found this horn. We seized it, sir, and bring it hither.

*Hakon.* 'T is well, Stein! Are there others than thyself who brought it?

*Stein.* A crowd of us.

*Hakon.* For this deed a feast shall be provided at the servant's quarters. Each one shall have for himself a horn of wine as large as this.

*Stein.* And all, sir, shall be drunk to thy health. [*Exit.*

*Hakon.* An ancient sacrificial drinking horn,
Of gold, enchased gold; a rare, old horn.
Upon this spot has doubtless stood, long since,

A shrine to Valhal's gods. And there they thought
To rear a church, and build their monkish cells.
'T was right, my men, that ye expelled them; right
That ye should win for me this golden treasure,
As rare as brilliant. Look, how runics chase
The golden rim. Let 's see, what 's written here. [*Reads.*

"If for thy guilt
Fortune forsakes thee;
Go to the gods, and
Give them thy best!"

[HAKON *stands for a long time deeply touched and amazed, then he rereads the stanza slowly and meaningly.*]

"Give them thy best!"
Ye crave the best ere ye are reconciled?
I understand thy sign, thou highest Skuld.[65]
I see thee wrapped within thy whitish cowl,
Thou sittest there beneath the Ygdrasil[66]
And starest into Urdur's fount.[67] Pray tell
Me, is the water red, is blood required?
"The best"! And what perchance may be the best?
My Erland fell; in him thou hast the best!
But Hakon hath not freely offered him;
The will, the heart must be in every gift
To regain the favor of an angered god.
Give them the best! There still remains to me
My little son, with golden hair, with eyes
As blue as heaven, as pure, as innocent
As fairest morning star, yet quick, and full
Of life as is the mountain buck; withal,
Of Hakon's blood, the latest drop;—not him,
No, no, not him, thou blessed Freia! Pray,
Thou crav'st not him, whom thou thyself hast given?
[*Deep in thought.*
Two kinds of offerings do the gods demand.
The one attests their splendor and their power;
For such are cattle, fallen foes required.

Then flames of joy ascend from earth to heaven,
And Odin smiles down from his royal stool.
The other offering burns to expiate;
Its blaze but smothers Valhal's wrath; and then
The heart must bleed, because the offering bleeds.
The scene is still, there 's neither song nor dance;
It is a punishment that turns the gods
From wrath to mercy. [*Looks at the horn.*]
Carved in plainest words
It reads: Give them the best! And wherefore brought
Me even *now*, this moment when I swore
The gods to work for them alone, just when
I promised — Hakon, fie; no weakness now!
Thorgierdur Horgabrud![98] Thou amazon,
Who ridest to battle on a snow-white steed,
Thy broadened shoulders covered with a cloak
Once dipped in steaming blood, the glaive of death
Within thy monstrous hand; thy bloody eye
Is all aglow for prey, thou reachest out
Thy hand,—thy dagger shines—enough! enough!
See, Hakon Jarl obeys! He trembles not.
[*Goes out trying to grasp the imaginary dagger.*

## Scene II

*A Wood*

Tangbrand *and* Griffin.

*Tangbrand.* 'T is well I found thee, Griffin. Where 's the King?
I'm much in doubt about this matter. Where 's
The aged man?

*Griffin.* They walk together, up
And down the forest, talking now of this
And now of that. The old man often speaks,
In terms ambiguous, of Olaf's deeds.

*Tangbrand.* Tell all; from whence he came, and what he said.

*Griffin.* We 'd gathered at the feast of Whitsuntide.
King Olaf seemed as gay as anyone
Around the festive board, when in there stepped
This aged one-eyed man. He placed himself
Beside the door. But Olaf, who is kind
To all, invited him to feast with us;
They talked of many things. The old man knew
Of all the wondrous happenings. In ways
Peculiar to himself, he joked and railed
At things wherein they differed. Thus he said:
"I see you celebrate Confusion's feast!
You call to mind that night when pious men
Received strange tongues and prated each to suit
Himself, nor since have understood each other."
At length the sultry chamber stifled him;
The summer night was clear and cool, and so
He begged the King to take a friendly stroll
Through forest paths. At length the King complied.
I followed close upon them, and alas,
They wandered far and wide. And once he led
The King to the mountain top and while he spoke
His finger moved through all the land. The moon
Shone clear. 'T was passing strange! When one beheld
Him in the distance, wrapped in bushy furs,
The stranger looked as if a ghost. I wished
The King would seek his couch; the night is damp.

*Tangbrand.* Where is he? Bring me to the king, my Grif.
Long since, the sun went down behind the sea;
Tomorrow when it rises it will greet
The holy day of Pentecost, and still
Our evening's mass has not been sung. I fear
For Olaf; never yet has he postponed
His pious dues. Come, haste: let 's seek the King. [*Exeunt.*

[*Olaf enters from the other side with* AUDEN.[69] *The latter wears a black cloak and a hood covers his head.*]

*Auden.* I understand thee well, my tender lad.
Inspiring songs within the vaulted church—

These touched thy heart; the splendid paintings stole
Thine eye. So thou didst think the impulse must
Be true. What thou didst feel, the North must feel,
Or else, — thy sword is drawn. Is not this so ?

*Olaf.* Thy hair is silvered o'er with age, thy mind
Is set upon the olden faith. I blame
Thee not that thou dost call my faith a fond
Delusion.

*Auden.* Set upon the olden faith?
'T is well; a fortunate expression this.
But tell me, Olaf, how else should one be ?
Can not we say of *All* that it is set ?
For faith is surely nothing more than strange
Propensity, an instinct, say, which draws
The infinite spark within the soul toward that
Which gave it birth, the invisible; a bent
Which varies as the thing it works upon,
Or varies as the seasons, or as Nature.
This striving toward the infinite is seen
In every fir, in every cloud-kissed hill.
The bold instinct to rear their heads toward heaven,
This is, we say, their faith. Thou seest they show
A common faith; thou must admit 't is not
In vain that everywhere, as far as eye
Doth reach, throughout the North, it bears the stamp,
Bespeaks the genius of a single mind.
In southern climes 't is otherwise. These leaves,
So stiff and slender, there are changed to soft
And tender blades; the trees no longer rear
Their fronded heads aloft, but bend themselves
Beneath the arch of heaven in pious curves —
Resembling much thy monks when at their mass.

*Olaf.* Strange man !

*Auden.* Where now the sky is ever blue,
Where sunsets paint themselves in red, and where
The woods voluptuous in repose, invite
To love and song, there wakes sweet music's art.

One sighs for tints with which to imitate
The radiance of the flowers. And love, dear love
Which flits through all, on all has left its stamp.
But now where Nature, more severe, brings forth
More stones than flowers; where heavy sheets of snow
Envelop half the year; where muscles grow
And harden more and more; where Nature says
"To lack, becomes a virtue, or to guard
With jealous eye our frugal share,"—ah, there
No pictured scene, no song enwraps us there.
But during endless winter nights the soul
Awakes with lofty manhood thoughts; there opens
The inner flower, then fondly shuts again
About a maiden's heart, both stainless, pure.
Not from those misty ever-changing tints,
But from these cliffs, imperishable rocks,
The gods arise and calmly, proudly view
Their handiwork. Thus inborn strength is driven
By inborn wants, to manly exercise.
Thus strength opposes strength; and bravery
And manhood are impressed upon the North,
As feminine tenderness upon the South.

*Olaf.* How strange!

*Auden.* When now a youthful lad, at first
By chance was driven toward the South, returns
And brings a basket filled with tenderest flowers
Of Italy, and longs to plant them here
On Norway's cliffs; when now the birch, the fir,
Are in his way and he uproots these grand,
These ancient forests, sparing not a tree
Of all those olden giants, since his weeds,
His roses needs must have a place to grow,—
Pray then if thou didst see him at his work,
What wouldst thou call him, sir?

*Olaf.* Away, away!

*Auden.* Perchance a hero? Aye, a warrior, one
Who fights for noble ends. And he who said,

"Boy spare my trees! Thy southern sensual weeds
Can never thrive on mountain air." Pray, sir;
What callest thou him?

*Olaf.* As thou art called!

*Auden.* [*Looking him straight in the eye.*] And who
Am I?

*Olaf.* Thou 'st said that Auden is thy name.
But who art thou?

*Auden.* Aye, who am I? Wise lad!
Who knoweth all things, surely knoweth me!

*Olaf.* A single eye is thine!

*Auden.* What need of more?
The night is clear, and with a single eye;
Tomorrow shines the sun; it hath no more.
Remember well what thou hast heard! Forget
Not soon the thoughts this moonlit night has sown
Within thy soul!

*Olaf.* Ah, Jesus, grant me strength!
Strange doubts and fears are tightening round my heart.

[*As* OLAF *turns away from* AUDEN *the latter quickly leaves and disappears among the trees.* TANGBRAND *and* GRIFFIN *enter.*]

*Tangbrand.* At length I find thee, Olaf! I have sought
Thee everywhere. How comes it, gentle sir,
Thou hast forgot the evening prayer? This was
Not so before; then too at such a time
As this.

*Olaf.* [*Turns about.*]
My Tangbrand! Where 's that strange old man?

*Tangbrand.* I know not where. Forget the stranger, who
Hath filled thy mind with heathen thoughts.

*Olaf.* My friend,
Hath evening mass been sung?

*Tangbrand.* Long since the sun
Did seek his rest; 't was then the time, but thou
Didst not attend my call. The stranger's words
Held fast thine ear, as if the Siren's song.[70]

III

*Olaf.* Who is that man?
*Griffin.* None seem to know him, none
Of all thy men. To me he's very strange.
He looks like Odin sir, in Hakon's grove.
*Olaf.* He said his name was Auden.
*Griffin.* Auden! Odin!
They mean the same.
*Tangbrand.* My Olaf, surely one
Of Odin's priests hath been with thee today
And sought with wild, ambiguous words, perhaps
At Hakon's hint, to turn thy heart. It may
Have been the fawning Jarl himself.
*Olaf.* Whoever
He is, he seemed a shadow sent from hell.
He wished to show how great, how base a sin
To tear the people from their olden faith.
*Tangbrand.* And gave in proof how well the old belief
Becomes their chilly North? That once this faith
Was introduced by strangers to the North
From far off eastern lands, — of this no word
Was whispered, I assume.
*Olaf.* Ah, Tangbrand; yes,
Thou 'rt right! The old belief was also once
A stranger here. What then avails his praise,
His madness for the warrior faith which he
Believes the North hath grown, and given its stamp?
*Tangbrand.* Of no avail, my Olaf. Northern climes
No more than southern, may usurp the rights
To offer brother's blood or violate
Sweet heaven's law.
*Olaf.* How true!
*Tangbrand.* I 'll not condemn
Entire the ancient heathen faith. For God
Hath not vouchsafed it life these many years
For naught; 't is but a ruin now. The laws
Of Christ were then unknown. Where there 's a choice
Then man should choose the best.

*Olaf.* Now speaks the truth.
Tomorrow morn, the day of Pentecost,
I hope to take both Hakon and his host.
*Tangbrand.* His slaves did steal the sacrificial horn
Which we unearthed, of which we thought to make
An altar-cup. An ancient rune which pleased
Me much was graved upon the horn. It ran:

"If fortune forsakes thee because of thy guilt
Then go to the gods and give them thy best."

This verse I wished to leave upon the cup;
What better gifts than hearts of innocence
And thankfulness? They tore it from my hand;
But let them have it; God will punish man
For theft as well as other sins.
*Olaf.* Behold
The sun ascends from out the watery depths!
He soon will add his blessing and his peace
On this the first of Norway's Whitsuntide.
We have no church; but out of solid rock
Hath nature worked for us a chapel. There
We 'll sing Ambrosian chants of praise. All doubts
Will disappear as now the gloom of night.
*Tangbrand.* Such words are worthy thee, my noble King.
[*Exeunt* OLAF *and* TANGBRAND.
*Griffin.* [*Who has stood deep in thought.*]
A priest of Odin? Aye; perchance the Jarl
Himself? But Hakon favors much the statue
I' the grove. For me, I know what *I* believe. [*Exit.*

### Scene III

*The Sacrificial Grove.*

*Enter* Hakon *leading his little son* Erling *by the hand.*

*Erling.* It 's cold, my father, very cold.
*Hakon.* My son,
'T is early morning yet; the air is chilled;
Art shivering?
*Erling.* No matter, father mine.
I 'm glad, for thou didst promise me that I
Might see the rising of the sun. How grand!
I never saw it rise.
*Hakon.* Along the east
Dost see those ruddy beams?
*Erling.* [*Clapping his hands.*] What roses! Look!
See there! What pretty roses! Father mine,
Come, tell me, whence come those pretty pearls?
Look, how they strew the valley here and yon,
And flash against the roses.
*Hakon.* Child, my son,
Those are not pearls, but morning dews; and that 's
The sun, which thou callest roses. Look! Behold,
It rises.
*Erling.* What a ball! How fiery red!
My father, can we ever go to see
The morning sun?
*Hakon.* All life is thither bound,
My child. For look, that beauteous flaming light
Which beams out yonder, that is Odin's eye.
The other, which thou seest at night, my son,
With paler beams and whitish blaze, that eye
Hath Odin pawned in Mimer's well,[71] to gain
A drink which makes more keen, more sharp his sight.
*Erling.* And where is Mimer's well?
*Hakon.* Out yonder, son,
The mighty ocean, tumbling 'gainst the cliffs;

The sea is Mimer's deep-dug well, that gives
To Odin's eye its strength. Aye, doubly bright
The sun comes up deliciously refreshed
By cooling morning waves.
*Erling.* But father, oh!
It rises much too high; I can't endure
To look at it; it burns my eyes.
*Hakon.* My son,
Th' All-father now ascends his fiery stool,
And soon his gaze will fill the world below.
His golden throne completely dazzles man.
For who presumes to look upon the King
Of day, of life, in all his noon-day splendor?
*Erling.* [*Looks about full of fear.*
Oh father, father, look! What horrid men
Are those, so old and grim, behind the trees?
*Hakon.* Be not so bold, my son! The gods, in stone,
The statues of the blessed gods thus hewn
By pious men. They dazzle not the eye.
Before them Askur's[72] sons may calmly kneel
And look upon their countenance undazed.
Come, view them closer, child.
*Erling.* No father, no!
I am afraid. See there; the one that wears
That long white beard, how ugly, grim, he looks;
He makes me shake with fear.
*Hakon.* Ah, Erling! Erling!
God Odin, he. Art thou afraid of Odin?
*Erling.* No, no; I fear not Odin, him who lives
In heaven yonder; he is great and good,
And never frightens me; he causes flowers
To spring from out the earth; just now he shone
Himself as if he were a flower. But that,
That pale-faced ghost, — he stares and stares, as if
He wished to take my life.
*Hakon.* My son, my Erling!

*Erling.* My father, let me bring the wreath of flowers
I hung on yonder bush, there where we paused,
And thou didst show me where the sun arose.
Then let 's go home again, my father, far
Away from all these pale and ugly statues.
For thou canst well believe that grim old god
Has nothing good in store for thee.
*Hakon.* Go fetch
The wreath, my child, and quickly come again. [*Exit* ERLING.
The sacrificial lamb should festively
Be decorated. Holy gods, look down
From heaven and see Jarl Hakon's faith and trust.
*Erling.* [*Coming back with a wreath of white flowers in his hair.*]
I 'm here, my dearest father! Here 's the wreath.
*Hakon.* Now kneel, my son, to Odin, ere we go.
Stretch forth thine hands aloft toward heaven and pray:
All-father Odin, hear thy little Erling,
And take him, keep him in thy 'loved embrace.
*Erling.* [*Falls on his knees towards the sun, stretches his arms towards heaven, and says childishly:*]
"All-father, hear thy little Erling's prayer,
And take him, keep him in thy 'loved embrace."

[HAKON, *who stands behind him lifts his dagger and is about to thrust it into the boy, but it falls from his hand.* ERLING *turns around without noticing the danger, picks up the dagger, and as he arises, says innocently to his father:*]

Didst drop thy dagger, father? Oh! How bright
And sharp! When I grow up, I too will have
A weapon just like this and [*In lower tone.*] father mine,
I 'll help thee kill thine enemies.
*Hakon.* How now!
My child! What monster fills thy mouth with words
Like these to move my heart?
*Erling.* My father, art
Thou angry? What 's the matter? Pray, what have
I done?

*Hakon.* Come, follow me behind the statue!
*Erling.* Behind that wicked man?
*Hakon.* Come, come, my boy!
There roses bloom behind the statue yonder.
No white ones though, the roses there are red,
Blood-red and purple roses! It 's a great
Delight to see how thriftily they grow.
Come, come, I say; obey me!
*Erling.* [*Crying.*] Father mine,
I have a fear for roses that are red!
*Hakon.* Away! Hark! Heimdal's[73] cock is crowing loud.
The hour has come, my son, the hour has come!

[*They disappear behind the statue.* EINAR TAMBESKIELVER *enters hastily, armed with spear and bow.*]

*Einar.* Where is he then? They told me he was here
In Odin's grove; and yet I find him not.
Where can he be? What does he here? No time
For prayer when battle calls.

[*He listens. The child's screams are heard from behind the statues.*]

Ye gods! How now? [*Calls.*]
Jarl Hakon! Hakon!
*Hakon.* [*Enters with bloody hands.*]
Here, who calls for Hakon?
*Einar.* [*Amazed.*] What means all this?
*Hakon.* Thine errand sir?
*Einar.* I came
To summon thee to battle. Olaf quickly
Has joined his army with the peasants' force.
They hasten toward the court. Thy men are all
In readiness to strike. I joined them. Come!
We sought thee everywhere. Again an offering?
*Hakon.* Aye!
*Einar.* This time what?

*Hakon.* Behind god Odin lies
The offering.
*Einar.* This will doubtless aid us greatly!
[*Goes to see the offering.*
*Hakon.* 'T is done; now courage, strong determination!
*Einar.* [*Returns amazed and full of wrath.*] Thou wrinkled sorcerer! What hast thou done?
*Hakon.* Sought Odin's favor; offered him my joy,
My own last hope and Norway's only fortune.
*Einar.* In hell may Nither[74] grind me 'twixt his stones,
Or crush me with his hammer, should I stretch
The bow to save thee from thy fate, although
I dearly love sweet Berglioth.
[*Tears a gold chain from his neck.*]
See! There 's
Thy chain! And thus I sunder every link
That hitherto has bound me to thy cause,
Thou pale, thou bloody man! From this time forth
I serve King Olaf! Ha, thine hour has come!
Thou 'st taught me, sir, to shudder 'fore thy gods,
King Olaf's God shall win. What hinders me
From straightway, by my sword, to thrust thee down
To hell? But no! More public, more debased
Shall be thy fall; I 'll seize thee, seize thee, aye,
And help King Olaf hang thee, like a thief,
Upon the topmost gallows. [*Exit.*
*Hakon.* This must I,
I, Hakon hear! [*At a distance horns are heard; also cries of "Hakon!" "Hakon!"*]
*Hakon.* [*Drawing his sword.*]
Ah, now the hour has come,
The hour that must decide for Christ or Odin.
Hark! How the cries resound! Mere Amazons,[75]
Mere Valkyrs, Odin's battle nymphs, who fill
The air with frightful cries and call to battle.
How swollen the veins of Heimdal's[76] temples, whilst
With all his strength he blows the battle horn!

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Thorgierdur Horgabrud![77] Give time! I come.
I offered thee my Erling, yea, my son;
A countless host of foes shall follow him. [*Exit.*

## ACT V

### SCENE I

**Rimol**

*A Hall*

Night. THORA and INGER are discovered, sewing, sitting by a table. A candle almost burnt to the socket lights the scene.

*Thora.* Thou 'rt sleepy, Inger.
*Inger.* Midnight comes apace.
But lady, there 's a knocking at the portal.
Perhaps 't is they.
*Thora.* 'T is but the clamoring storm.
The house doth shake as if a fever held it.
A gruesome night! A constant flood of rain
And hail! A winter darkness cloaks the earth!
Hark, how it beats upon the gate!
*Inger.* Dost think
Thy brothers come to-night in such a storm?
They 'll sure await the morning. Have no fear.
*Thora.* If thou art sleepy, Inger, go, retire.
No sleep for me! I know the battle raged
At early morn. My brothers promised me
In sooth, they 'd come as soon as they were free,
To tell me how the battle stood. Go thou
To bed.
*Inger.* Well, then I 'll rest awhile since thou
Dost urge. But hark! I hear that knocking still
Upon the gate. 'T is not the storm.
*Thora.* Thou 'rt right!
Let Hadding open it. I hear the tramp
Of footsteps on the stones.

*Inger.* 'T is they! Ah yes,
'T is they! I 'll bring the lights; 't is surely they!
Rejoice my Thora! [*Exit.*

*Thora.* Ah my heart doth beat
As if 't would burst its bounds! My Alf, my Skialm
Opposed to Hakon Jarl! Whichever side
May win, the wretched Thora still hath lost.

*Einar Tambeskielver.* [*Entering.*]
Good morrow, Thora, for, unless I err
'T is past the midnight watch. The early cock
Proclaimed the hour before I reached the cliffs.
I cóme to tell thee how the battle stood.
My name is Einar Tambeskielver. Fear
Not thou to meet a friend of Hakon Jarl.
For since, in utter frenzy he hath slain
His son, an offering to the gods, to gain
Their favor on today's dark battle field,
I 've been to him a relentless foe.

*Thora.* Ye gods!

*Einar.* Thou 'rt right! The grim assassin quite deserves
Aversion. All his deeds excite a loathing.
Thou hast reasons for thy hate, as I,
For deeply hath he harmed, insulted, thee.
Today I first espoused King Olaf's cause
So my acquaintance with thy brothers was
But brief, but still we learned to love each other.
In battle one may see within an hour
What oft in peace would take a life-time. Ah,
They fought like men, and so in truth did all.
As lightning, Olaf scattered Hakon's force.
'T was warm beneath the blood-bespattered shields,
And swords grew hot when bathed in reeking wounds.
The Valkyrs fought at every warrior's side;
They cried for blood and lastly had their fill,
For Odin never poured more bounteous wine
In Valhal's halls. The greater part were slain.
But Hakon and his slave escaped, and them
We hotly seek.

*Thora.* But sir, my brothers? Aye,
My brothers? Thou hast come, most noble sir,
A stranger; hither, and at night—I fear—
My brothers?
*Einar.* They were hindered,—could not come
Themselves. Rejoice my noble Thora! Skialm
And Alf rode out beneath the rising sun
And entered Valhal; long ago they sat
At Odin's side.
*Thora.* Oh Freia, gods!
*Einar.* Rejoice,
Most noble Thora! Aye, be glad. The gods
Do not decree to every man at birth,
So grand a death. They ever took their stand
Where thickest raged the battle. Side by side
We fought. Jarl Hakon chafed and foamed as doth
A maddened bear. The fight was fierce; for hosts
Of men, embittered, met like angry waves.
The half of Norway fought for Hakon Jarl,
The other half for Norway's king; his fame
Had spread abroad from town to town, like flames
In sun-burnt grass. Thy brothers, by their choice,
Were constantly opposed to Hakon Jarl.
They swore his death; they swore to avenge thy wrong,—
Then sank they each before his deadly sword;
He strikes a heavy blow and doubly hard
When energized by wrath. Aught more? The Jarl's
A worthy executioner; say what
They will, one finds not Hakon's equal here
In the North. He proved a hero in the fight.
*Thora.* My Alf! My Skialm! My dearest brothers! Oh
My brothers!
*Einar.* I am jealous of their lot!
I envy them, for now they 're Odin's priests;
They shine in burnished coats of mail and round
Their loins hath Vauland forged the fiery sword.—
Tomorrow we shall lay them 'neath a mound

Which must defy eternity; and round
About the grave King Olaf soon will place
Memorial stones.—"Greet Thora! Greet our sister!"
They cried,—the final words thy brothers spoke.
I promised this, and I have kept my word.
I have a crowd of Olaf's men, with whom
I seek the Jarl, as Olaf with the rest.
We meet again at Gaulaa. Meanwhile he
Hath summoned all the council, where I know not.
I came this way, so roundabout, to bring
These tidings for thy brothers' sake. I think
It rains, my plume is dripping. Soon I hope
We 'll catch the Jarl and bring thee thy revenge.
May Frigga gladden thee! Farewell! I haste. [*Exit.*

*Thora.* Most holy gods! What awful fate have ye
Decreed for Thora? Oh, what awful crime
Hath this poor bosom wrought, since it must needs
Be crushed?

[*A man enters, wrapped in a cloak, his face covered.*]

*Thora.* What unknown guest? A stranger! Speak!
Thine errand, sir?

*The Stranger.* Are we alone? In safety?

*Thora.* Dost speak of safety, thou, a man unknown,
Who enters, unannounced, a woman's room
And frightens me? Speak sir; thine errand here?

*The Stranger.* [*Throws aside his cloak.*]
Thou knowest me, Thora.

*Thora.* Gods! 'T is Hakon Jarl!

*Hakon.* Aye, he! The same; the same!

*Thora.* Thou comest to me?

*Hakon.* By Valhal's gods, thou hast the right to feel
Surprise; but I have yet to see the stag
That doth not seek for shelter, even the most
Incongruous place, when followed close by hounds.

*Thora.* Thou 'rt pale my Hakon, ah, thine eye is dim.

*Hakon.* But Odin knows I fought; aye; like a wolf

When she protects her young. With this strong sword
I sent to Valhal countless hosts of men.
But now my strength is spent, my troops are lost,
My fate deceived me, Norway's ancient sword
Is dulled by Olaf's southern witchery.
One army faithlessly deserted me.
Not one is left in whom I dare confide.
Too heavily and cold as ice, the hand
Of Rota weighs upon my temples now.
This night I 've come, accompanied by my slave,
Aweary from the day's hard fight, alone,
Forlorn. A fiery thirst has plagued me long.
This cup looks fresh,—nay, let me drink, I pray!

*Thora.* O Hakon, wait! And let me bring thee—

*Hakon.* [*Drinking.*] Wait!
No never! Ha! Already I 'm relieved.
At Gaulaa,[78] there my charger fell at last;
I killed it, then tore off my cloak and dipped
It in the blood to lead mine enemies,
Who hotly follow me, astray.

*Thora.* O Hakon!

*Hakon.* By chance I passed thy place, and like a flash
It came to mind how oft, how strongly thou
Hast vowed that none have loved me such as thou.
I am aware that love is often changed
To hate. 'T is well, a chance to prove it now.
Ah, Thora, here I stand! From Olaf's hounds,
From Olaf's ruthless grasp wilt thou protect me?
Then thanks for such a love which hitherto
I could not understand. Shouldst thou refuse,—
Ah, Thora, how it costs, yea, dearly costs
For Hakon thus to beg!—Well then I go,
A wanderer through the night. I 'll seek the first,
The highest mountain top, and there I 'll view
The fatherland and bid farewell to Norway.
Then calmly,—calm through stern resolve, I 'll fall
Upon my sword. The spirits of the wind

Shall seize Jarl Hakon's soul and on their wings
Shall carry it aloft to Odin's hall.
Th' all-seeing sun shall find my lifeless frame
Upon the mount, and say: "He lived and died
Exalted high above the multitude."

*Thora.* O Hakon, Hakon! Speak not so. Nay, Hakon!
I hate thee not, no, no, I hate thee not;
And I will house thee, keep thee, yea, protect thee
Against a thousand enemies. [*She seizes his hand.*]

*Hakon.* But Thora!
Dost know that I have slain with this same hand—
The little Erling whom thou lovedst so well?

*Thora.* I know it, aye, an offering to the gods,
Which shows, O Hakon, but the far extreme
To which ill-fated destiny hath brought
Thy rarest of all souls of men.

*Hakon.* But Thora;
Dost know this hand which thou dost take so fondly
Has—ah, it pains me much to—

*Thora.* Yes, I know,
This hand has killed my brothers in the war.

*Hakon.* And still?

*Thora.* Thou 'lt find that Thora loves thee still.
Yes, Hakon! Harshly hast thou treated me;
Thou 'st pushed aside my love with bitter scorn;
Thou 'st killed my brothers, dearly loved! But then
In war 't is life for life; and Einar says
That Odin took them to his blessed hall.

[*She hides her face in her hands and weeps; soon she raises her head and stares upon the Jarl.*]

Ha, tell me, Hakon! is it thou who standest
In Thora's room, in this dark forest home,
So far removed from Hlade's brilliant throne,
With shuddering darkness creeping round about thee,
Where storms are beating 'gainst the castle walls,
As in my bosom? Tell me, sir, I pray,

That pale-faced, silent man, here in the room,
Without a shield, without a purple robe,
Who weary, leans upon his sword, can this
In truth be Hakon Jarl?
*Hakon.* That shadow, aye,
Was once stout Norway's mighty lord; the North's
Great men obeyed his slightest glance. He fell
In battle, in a battle which was fought
At Hlade. Ha, 't was long, long years ago,
'T is quite forgot! His ghost is restless, stalks
About at night; Earl Hakon was his name.
*Thora.* I am revenged, yea, terribly revenged!
Avaunt, thou fiendish spite! Return, oh love!
A wolf o' the forest, ha! No woman I,
If hate and rancour fled not from my breast
At such a sight. O rest thee at my heart!
Come Hakon, let me cool thy feverish brow,
Restore the hero's look within thine eye.
[*Embraces him.*]
*Hakon.* [*Wildly.*]
Fond Norway's gentle maid, pray what 's thy name?
*Thora.* Sweet violet, is what the maidens call me.
A tiny flower I was of daintiest blue
That throve among thy garden oaks; 't was there
I drew my life; a flower that faded, drooped,
When thus uprooted from its sheltering nook
And nursing shade.
*Hakon.* Sweet violet!—By Thor,
A charming name!
*Thora.* O Freia! How is this?—
A fever-chill hath made thee tremble. What!
Dost weep? By Valhal's everlasting gods!
Ha, strange indeed! Amazing spectacle!
Saw ever Thora tears on Hakon's cheeks?
*Hakon.* [*With wild friendliness.*]
Sweet violet! Pale, wilted, dying flower
Upon a hero's grave, do Hakon's tears

Astonish thee? Hast ne'er before beheld
A stone that wept when from the winter's cold
'T was warmed beside the flame? A death-sweat this,—
Pale death's own flower! Let it not frighten thee.
*Thora.* Ha, blessed Freia!
*Hakon.* Mountain snows are melting,
'T will soon be over; sturdy winter yields
And flows away in tears, it flees apace
Before the sensual spring, for Olaf's flowers.
The Jarl has gone; his pallid ghost alone
Returns. Approach the corpse without a fear.
Hurl through this shadowy mass a spear and bury
It deep within the earth,—and then, he walks
No more, but finds repose.
*Thora.* Control thyself.
My Hakon! Calmly weigh thy words, nor speak
So wildly. The greatest soul though strong and proud
Must yield at last to nature's higher law.
Thy noble heart for years hath never been
Unstrung; but choked by spiteful foes, aye crushed;
Unloosed, it now relents and tears must flow.
Come, follow me! Beneath my castle lies
A secret cave whose walls are solid rock.
None know the cave but I, nor saw it; there
Will I conceal thee till the clouds have passed,
Until thy better fortune smiles.
*Hakon.* My Thora,
Dost think clear daylight smiles beyond this vault?
Ah, tell me true?
*Thora.* I have no doubt, my lord!
*Hakon.* And down this cellar, vault, this cave, this deep
And dark unknown beneath the earth, where even
The enemy must pause, where danger halts,
Far down this gloomy fortress, next to hell,—
There, Thora, thou dost lead me?
*Thora.* Aye, my lord!

*Hakon.* [*Gladly gives her his hand.*]
My Valkyrs, come! My glorious Hella! Come;
Dauntless I go.
*Thora.* O gods! Ye gentle powers!
*Hakon.* Dost think I tremble at thy countenance,
O incensed woman? Thou art pale, thy lips
Are blue; thou dost not kill as do thy sisters,
The battle-nymphs, with but a passing stroke.
Thy sword is slow to kill; with ice-cold fear
Thou strikest first his courage, then the man.
'T is all the same. Come hasten onward! Still
There smolders in my breast a spark of pride.
With hasty steps I follow toward the grave.
*Thora.* Ye gentle gods, grant Hakon strength to live!
[*Exeunt.*

## Scene II.

*Woods near Gaulaa.*

Olaf Trygveson, Carlshoved, Jostein, Griffin *and a host of warriors.*

*Griffin.* Gray dawn now steals upon us, sir. It seems
The day will be as fair as night was foul.
Art thou not weary, sir? Perhaps thou 'lt rest
Beneath the trees, the while thy horses feed?
*Olaf.* No rest for me,—I swore a solemn oath,
No rest for me before the Jarl is found.
That shameful crime he wrought upon his son,—
That must be punished, it shall cost his life.
Where find example for 't, for such a deed?
A holy myth, from far off days relates
How once a partiarch, his father-heart
All crushed with grief, went out to do God's bidding;
'T was only done to try his faith. The bright
Sharp steel had surely fallen from his grasp,
If Heaven had not restrained his hand.[79] But Hakon!—
*Jostein.* My lord, thou 'rt right, the deed was bloody, awful!

*Olaf.* His force is scattered but not beaten yet;
Young Einar braver now than wise, speaks much
Of victory. Not so! Give Hakon time
And he will rally all his men and fight
With sharpened wrath. I've no desire to waste
The land through ceaseless war; nay, rather, heal
Its wounds with Heaven's sweet peace. His sin, the Jarl
Must expiate with his own blood! The while
He lives, no hope for peace; no Christian rose
Can thrive so long as Hakon draws his breath.

[EINAR TAMBESKIELVER *enters with* HAKON'S *bloody clothes.*]

*Einar.* No longer need we search the Jarl, my king.
By yonder brook we found Jarl Hakon's steed
Cut down and at its side this cloak, besmeared
With blood. Thy men have doubtless found him there
And there he met his death.
*Olaf.* Ha, tell me friends,
Is 't true? Is this his cloak?
*Griffin.* Aye, aye, his cloak!
But where 's the Jarl himself? Was also he
Beside the brook?
*Einar.* No, not the Jarl! Alone
His steed, his mantle, both besmeared with blood.
*Griffin.* Bring forth the Jarl himself! Aye, then we 'll rest,
But not before. Not thus we know the Jarl.
Unless I err, he found another cloak.
My King, be not misled; this trick is like
The Jarl, and done to lead astray the blind.
I know him!
*Olaf.* Then, to horse! We 're close to Rimol.
I there convened the council, and shall hear
If aught is known about the Jarl.
*Griffin.* There lives
His mistress, Thora.
*Einar.* Former mistress, Griff!
The fickle Jarl deserted her; and both

The brothers were his deadliest foes.

*Griffin.* A search
Can do no harm. They say, "Old love rusts not."

*Olaf.* Look, yonder comes the sun. To horse! Away!

[*Exeunt.*

## SCENE III.

*A Rocky Cavern.*

*Enter* HAKON *and* KARKER; *the latter bearing a lamp and a basin of food.*

*Karker.* So this is the cave where we must hide? There is none too much room. Where shall I set the lamp?

*Hakon.* Hang it in the corner on the wall.

*Karker.* Aye, that I can. And here are seats hewn out of the rock, so that one can rest. My lord, wilt have some breakfast now? All the blessed day no food has passed thy lips.

*Hakon.* No! No food for me! But, Karker, thou mayst eat.

*Karker.* Then I will with thy permission. [*Seats himself and begins to eat.* HAKON *walks back and forth taking long strides.*] My lord! I say, this is a gloomy hole. Didst see that coffin, that black coffin, inside the door where we entered?

*Hakon.* Hush, I tell thee, and eat! [*Aside*] In this dark cave hath Thora walked, spent many a sleepless night, alone. It was made to be her grave. That sombre coffin she ordered made secretly. It was here she planned her lovely body should waste away and decay. [*Looks at* KARKER.] Slave, why dost thou not eat? At other times thou hast a greedy appetite. What ails thee now?

*Karker.* Ah, my lord; I have no least desire for food.

*Hakon.* No desire? Why so? Eat, my lad! Be glad, rejoice, trust in me, thy master.

*Karker.* Ah, but sir! Thou thyself art downcast, sick at heart.

*Hakon.* Sick at heart? Slave! How darest thou? I say, be merry! If there is no desire to eat, just now, then sing! Sing me a ballad!

*Karker.* What shall I sing?

*Hakon.* Sing what thou wilt, but rather one wherein the words are wild and boisterous, as rain and hail in winter-storms. A lullaby, slave! A lullaby!

*Karker.* A lullaby?

*Hakon.* Aye, that this grown-up child may slumber, lose himself in dreamland without a fear.

*Karker.* I know a famous warrior-song, my lord.

*Hakon.* Hath it a mournful ending? Doth it seem at first 't would all be well, and ends at last in infamy and crime?

*Karker.* No, my lord. It is sad at first.

*Hakon.* I like it then. This turn that all must open quietly and joyfully, that sadder may seem the ending, is a loathsome trick in all our poets. Let the early dawn be gray and dismal, the worst does not surprise us then. Begin thy song.

*Karker.* [*Sings.*]

> King Harald and Erling went sailing one night
> By light of the moon and the wind's refrain.
> But when they came to Oglogaard,
> The doughty Jarl was slain.[80]

*Hakon.* How now, slave! Is all thy reason gone? Dost sing to me my father's death-song?

*Karker.* Why? Was Sigurd Jarl thy father? That I never knew before. Aye, thou 'rt right, he had a gloomy ending.

*Hakon.* Hush!

*Karker.* There is not even a piece of matting here upon which one can sleep, not to speak of straw.

*Hakon.* If thou art sleepy stretch thyself upon the ground; so have I done many a time.

*Karker.* That I will with thy permission.

*Hakon.* Sleep, sleep! [KARKER *throws himself upon the ground and falls asleep;* HAKON *looks at him.*] Torpid nature! Asleep so soon? That tiny spark which proved thee to be a living being and not a lump of inanimate clay, now smolders feebly beneath a pile of ashes. Well for thee! Ah well for thee! Here it is all aflame! Here it rages with a force that is uncontrollable. Didst thou sing my father's death song, at this very

hour, as a wink from the Norne? Shall Hakon's death resemble Sigurd's? Sigurd was, as I, a bloody man, a zealous worshiper of the olden gods; under guise of friendship he slew King Athelstein,[81] the pious, and checked his work. [*Uneasily.*] God Odin, hath indeed the spotless Christ overturned thy power? Must he fall, who checks the southern faith?—Ha! This cave is chilly! It is cold and damp.—[*For a time he walks back and forth, then remains standing looking at* KARKER.] He dreams! Dangerous frowns contort his face and wrinkle his forehead. Fie! There he lies and grins, beneath the lamp as if he were a ghost. [*Shakes him.*] Slave, wake up! Karker, awake, I say! What means this disgusting smile?

*Karker.* Ah, sir; I dreamed.

*Hakon.* And what didst thou dream?

*Karker.* I dreamed—

*Hakon.* Hush! Be quiet! What noise is that above us?

*Karker.* An army of men, sir. Dost thou not hear the rattling of weapons and the coats of mail? Ha; these are King Olaf's men, my lord; they search for thee.

*Hakon.* This ancient vault is all unknown, and Thora gave to me its key. With iron and powerful locks the doors are closed; we are safe; none enter here.

*Karker.* [*Listening.*] Listen, sir! Dost hear what the herald cries, loud-voiced, above my head?

*Hakon.* What is it, slave?

*Karker.* That King Olaf rewards with honor and with gold whoever brings Jarl Hakon's head.

*Hakon.* [*Looking straight at him.*] That thou wilt never do? Wherefore tremblest thou? Why art thou so pale? What makes thy lips so blue?

*Karker.* Ah, sir; I have not yet recovered from my dream. Tell me, Hakon, what it means. Thou knowest how it is done; thou dost interpret dreams.

*Hakon.* What was thy dream?

*Karker.* At first I dreamed that we two were out on the sea in a small boat; I sat at the helm—

*Hakon.* Which means,—on thee depends my life, the number of my days. Karker be true; stand by me in this hour of need and I will reward thee better far than Olaf.

*Karker.* I had another dream.

*Hakon.* What was it, Karker? Speak!

*Karker.* This time I dreamed, a dark and stoutish man descended from the cliffs and said that now all fiords were closed against us.

*Hakon.* Karker! There thou didst not dream so well; this signifies a brief life for us both. Be true Karker, be true! As thou hast often told, we two were born the selfsame night; so too the hours between my death and thine are few.

*Karker.* And then it seemed to me I stood at Hlade, where King Olaf had a golden ring placed about my neck.

*Hakon.* Which means he will place a halter of twisted hemp about thy neck, if thou art faithless to thy master. Seat thyself in the corner yonder! Here in this corner I will rest. Then we both will sleep.

*Karker.* As thou wilt my lord.

*Hakon.* Where goest thou now?

*Karker.* I first would trim the lamp.

*Hakon.* Go, sit down, I tell thee! Let the lamp burn! Peradventure thou mightst put it out, then we should sit in gloom and darkness. I never could comprehend how people at the evening hour can calmly put out the light before they go to bed; it is a gruesome picture of death, blacker and more awful than death itself. What burns as strong as vividly as a light? What becomes of a light when it goes out? Leave the lamp untouched; the flame is feeble, true, but still it burns. As long as there is life there still is hope. Go, seat thyself, my son! [*For some time they sit quietly.*]

*Hakon.* Well Karker, art thou asleep?

*Karker.* Aye, my lord!

*Hakon.* Ha, dull, half-witted slave! [*Rises and walks back and forth.*] Hakon! Hakon! Is this stupid beast the last remnant of thy fleeting power? I trust him not; for what image of duty and faithfulness can such a clouded brain conceive?

Like a chained dog he fawns upon the one who holds the choicest piece of meat. [*Aloud.*] Give me thy dagger, Karker! A slave should never bear a weapon.

*Karker.* Master! Thou hast given it me thyself. Here it is. [*Reaches it to him.*]

*Hakon.* Now sleep!

*Karker.* Immediately! [*Lies down again.*]

*Hakon.* A fever shakes me, fires my blood and brain! I am weary and worn from fighting all the day and retreating all the night. But still I dare not sleep! This sordid slave—yet I will rest awhile, but guardedly refrain from sleep. [*Sits down and straightway sleeps.*]

*Karker.* [*Rises quietly.*] Now he sleeps! He bears me no confidence! He fears that I will betray him. King Olaf offers money for his life; what more can I expect from *him?* He stirs. Help, Thor! He walks in his sleep.

*Hakon.* [*Rises, still asleep. Walks with stiff heavy steps to the center of the cave.*] Guldharald! Graafeld! Ha, what do ye here? Leave me, I say; ye both deserved your death. A traitor? I deceived you not through friendly guise.—What, all ye women here? Go home; begone! I have no more time to waste. And then your bridegrooms—and Odin's statue—it lay in the dust—thou didst bite upon the hook, Olaf! And now thou dost wish Hakon to bite on death's sharp hook.—Who cries behind yonder bush? Ah, that is the worst of all. Erling, Erling, weepest thou? Did I plunge the knife too deep? Oh, blood, blood is flowing from thy breast, out amongst the roses. [*Cries aloud.*] Ha, Karker! Karker!

*Karker.* My lord.—Still he sleeps.

*Hakon.* 'T is done, 't is done! Here is thy dagger! Plunge it into my breast!

*Karker.* This thou wilt repent, my lord, when thou art awake.

*Hakon.* I deserve it, Karker, yes by Odin! Bury it quick!

*Karker.* [*Takes the dagger.*] He is my master; I must obey him.

*Hakon.* Ha, haste thee! Haste thee, Karker! before I awake. Thou or I must die.

*Karker.* [*Buries the dagger in Hakon's breast.*] Then it must be thou![82]

*Hakon.* Then heaven struck me with its avenging flame. Olaf, Olaf! Thy curse is realized. [*Dies.*]

*Karker.* It is done; now there is no time for regrets. If I should scream and howl his life would never return. I'll take the key from his pocket, carry him up the passage to the door and there reveal to Olaf all that is done; then he will honor me with silver and gold. What is done is done! He begged me to kill him; I have only done my master's bidding. [*He lifts the body to his shoulders and bears it away.*]

## Scene IV

*A Roomy Square Outside Thora's Castle*

Olaf Trygveson *stands armed with shield and spear on a large stone, surrounded by the people of his council.*

*Griffin.* Here come the peasant folk from Throndhiem, sir.
The council is complete, not one of all
The summoned spokesmen fails. There Bergthor comes,
The smith, the sage of Throndhiem's folk. He fought
With thee 'gainst Hakon, yesterday, but saw
Thee not, as darkness fell before the fight
Was done. He's every inch a man!

[*Enter* Bergthor, *followed by a crowd of peasants.*]

*Bergthor.* See there
He stands; look brothers, there he stands, a King
Upon the council's royal stone, as if
He were a Goldenhair, an Athelstein! [*Takes off his cap.*]
Art thou King Trygve's son?

*Olaf.* Aye, that I am,
King Trygve's lawful son.

*Bergthor.* A fair complexion!
One sees in him at once the ancient stock.
Sir, thou hast summoned here the council; I

Am spokesman for the farmer-folk of Throndhiem,
Because the eldest. Welcome to our land!
With thee we fought 'gainst Hakon yesterday;
But see thee first today. No time to look
About in battle. Each of Norway's sons
Hath longed for thee. With joy we choose thee now
To be our King, whereto with honor thou
Art born. See here, my King, I bring this crown;
Jarl Hakon bade me forge it for himself.
I fitted it about an iron ring,
A measure used for Halfdan Svarte's crown.
For Hakon's head it proved a sheer misfit,—
It blinded both his eyes. Now let us see
If thy head fits the crown.

[OLAF *places the crown on his head.*]

Ha, look! It sits
As were it forged about his brow. Now strike
Upon your shields, my men, and choose him King.

[*Clashing of arms.*

*The Peasantry.* Hail Olaf Trygveson! Hail, hail, our King!
We swear allegiance, vouchsafe loyalty
To thee our King. We swear aloud by Odin,
By all the gods!

*Olaf.* One God is quite enough,
My gallant Norway's men; yea, swear by One
Alone, the living God, who sees, who hears,
Who knows us all, from yonder heights in Heaven.

*The Peasantry.* By Olaf's God, by Olaf's God! We swear!

[*Clashing of arms, and cries of joy. A noise is heard outside the place.*]

*Olaf.* What tumult yonder?

*Einar.* Sir, the sun has pierced
The lowering thunder clouds; the storm is passed.
Upon his shield they bring thee Hakon's corpse.
His former love, the Lady Thora, hath,

As Grif assured us, kept her strong devotion
And in an unknown cave hath hid him. There
His slave has murdered him.
*Olaf.* Hast thou beheld
His corpse, and art thou sure it is himself?
*Griffin.* Aye, sir! Himself this time and not his cloak;
He lies death-pale, his blood still oozing forth
From out his wound.
*Olaf.* Peace keep his soul in death!
Now take the corpse where first it lay, where thou
Didst find it, Grif. His death atones for all.
My wrath is quenched. Poor woman, loving, true!
Give back to her his honored dust. The slave
Who thus betrayed his master, his reward
Is death.
*Griffin.* My lord, it shall be done.
*Olaf.* [*Descending.*] And now
Away to Hlade, come! Who follows me?
*Bergthor.* The whole of Norway, sir!
*Olaf.* 'T is well; you all
Shall be my guests. The day doth promise us
A friendly night. The horns shall pass from bench
To bench in Throndhiem's merry grove; the wine
Shall flow to Olaf's welcome.
*The Mass of People.* Hail the King!

[*Clashing of arms.* OLAF *goes, all following.*]

## SCENE V

### *The Underground Cave*

The lamp still burns. Two men enter with a black coffin. They place it in the center of the vault and then pass out again. THORA enters slowly with a drawn sword and a large wreath of evergreens. She stands for some time looking at the coffin and at length says:

*Thora.* At last, my Hakon Jarl, thou art enshrined!
And here at Thora's shrine—that I had not
Foreseen. May peace be with thy weary bones
Within the grave. If thou hast sinned, thou'st paid

The price therefor, and none hath need to speak
Contemptuous thoughts or slurring words to cloud
Thy memory with infamy. I love
Thee here in death as I have loved in life.
But yesterday throughout the North, thy sun
Did shine, as heaven's sun, whose glory all
The world reflects. Now all the hosts of men
Have quite forgotten thee, and turn their eyes,
Their thoughts, toward stranger suns. One lonely heart,
A woman's, beats in quiet sorrow still
Beside thy dear remains. Pray then let her
Bestow the honor due thee, which thy men
Forgot through joy's debauch.

[*She places the sword and the wreath upon the coffin.*]

From Thora's hand
Receive this forest wreath, a wreath late plucked
From Norway's haughty fir, which twines itself
About thy warrior-sword; 't will signify:
A northern hero this of rarest mould,—
A flower choked by winter's biting frost.
Some day the Saga of the North will tell,—
When time's rough hand hath soiled the written page,
When great achievements pass from mouth to mouth,
The colors blurred: "An evil man was Hakon,
A cruel worshipper of heathen gods."
With terrors they will name thy name. But I,
I shudder not; nay, Hakon! for I knew
Thee best. A mighty power, a mighty soul
Was sacrificed because of wild delusions.
Then calmly sleep, thou noblest of the North.
A thousand fond good-nights! Aloft in heaven
God Odin satisfy thy soul! I leave
Thee now in solitude. When next the door
Shall open, Thora's slaves will bring her corpse
And place it where it lived, at Hakon's side.

## NOTES

PAGE NOTE

4 1. *Hlade.* The location of Hakon's palace, and during the eighteen years of his rule the political center of Norway.

4 2. *Harald Graafeld.* King of Norway 950–963. Through the scheming of Hakon he was lured down to Denmark where he was killed by Guldharald who aspired to the kingship of Norway. His nickname Graafeld means Gray-skin. The circumstance of his getting the name is as follows: A trader had brought a shipload of furs. One day he complained to the king that he was unable to sell his merchandise. The King asked the trader to present him with a fur. When the request was granted, the king put on the fur, and all his men to imitate their king bought furs until the whole cargo was sold.

5 3. *There are sixteen others.* "Was there ever a land and sixteen earls so under one ruler?"—Einar's *Vellekla,* v. 29.

6 4. *Olaf Trygveson.* See *Introductory Note.*

6 5. *Hakon Jarl.* See *Introductory Note.*

6 6. *Thor.* Next to Odin, his father, Thor was the principal god of Norse mythology. The Roman Mars. The hammer was his destructive weapon.

7 7. There were twelve chief gods, or Aesir (dwelling in Asgard), besides Odin (the 'All-Father'), viz.: Thor, Baldur, Niord, Frey, Ty or Tyr, Bragi, Heimdal, Hod, Vidar, Ull, Forsetti, and Loki or Lopt.

7 8. *Frigga.* The goddess of love and wife of Odin.

7 9. *Freia* or *Freya.* As Frigga also the goddess of love. She was the daughter of Niord, and to her belonged one-half of all who were slain in battle.

9 10. *As late thou didst thy wit.* The reference is to the successful trading expedition from which Thorer has just returned.

10 11. *Eivind Skaldaspilder.* Hakon's court-poet. Spilder (Spillir) means 'robber' or 'spoiler.' Some authorities think that he received this nickname because he eclipsed all other poets, hence 'spoiled' them; others contend that he was a great plagiarist, that he 'robbed' other poets and hence was called the 'poet-spoiler.' "The line here quoted from Eivind is not found in what is left of this poet's works."—*Liebenberg.*

11 12. *King of Dublin.* Oehlenschlaeger is not always true to actual history. Olaf was not king of Dublin, but that king's son-in-law.

11 13. *Harald Fairhair* (Haarfager). King of Norway 860–930; son of Halfdan the Black. Harald was Olaf's great-grandfather.

11 14. *Dancvirke,* 'Danes' work.' This was an ancient entrenchment erected by King Göttrik in the 9th century as a protection to Denmark against invasion from the South. It is often referred to as the 'Wall,' or the 'Bulwark,' of the North.

11 15. *To Harald's aid.* Harald Blaatand, the son of Gorm, king of Denmark 935–985. After the death of Harald Haarfager, he was also ruler in Norway. He was forced by the German Emperor, Otho I, to accept Christianity.

11 16. *The lineage of Harald.* This refers to Harald Fairhair.

12 17. *A ransomed thrall.* See note 27, below.

PAGE NOTE

12 18. *Valhal* or *Valhalla.* The abode of Odin in Asgard, the realm of the gods. It was originally the abode of the dead, but became in the Viking age the warrior's paradise to which only those go who are slain in battle.

12 19. *Aesir.* Aesir is the collective term used for all the gods in Scandinavian mythology.

12 20. *Aukathor* or *Age-Thor.* Another name for Thor.

14 21. *Berglioth.* Probably Hakon's deceased wife, whose real name was Thora; not his daughter Berglioth mentioned later.

15 22. *This merchant prince.* The merchant prince is Guldharald.

15 23. See *Introductory Note* on Hakon Jarl.

16 24. *Limfiord.* A sea passage cutting off the northern portion of Jutland, Denmark, from the main division. *Halse,* a small town on this fiord. "He (Harald Graafeld) was doomed to lie on the broad bank of Lim-firth, at Halse on the sand he fell. It was . . . (Hakon) that planned the slaughter."—*Glum Geirason,* in the "Greyfeld-Drapa," *Lives of Kings.*

16 25. *My last exploit at Hjöringsvaag.* This refers to the battle of the Ioms-wickings, for which see *Introductory Note* on Hakon Jarl.

16 26. *Bue.* For the Bue incident see *Introductory Note* on Hakon Jarl.

16 27. *The Russian Valdemar.* Later on he is spoken of as Olaf's foster-father. Olaf when a boy was sold into slavery. His uncle, who served the Russian Valdemar, came across him by chance, ransomed him, and took him to the Russian court, where he became a great favorite of the king and queen.

19 28. *Dovre* or *Dovrefield.* A spur on the Scandinavian mountains in Norway famous for its quarries.

20 29. See note 47, below.

22 30. *Vauland.* The Norse for Wayland, the invisible smith of Berkshire, England. It is natural that Bergthor should swear by him.

23 31. *Melhus.* An old ruin in Guldalen, Norway.

23 32. *Halfdan Svarte* (The Black). The father of Harald Fairhair, noted chiefly for being the ancestor of a long line of illustrious kings.

27 33. *Konunga-tal* says that Hakon Jarl ruled "one-score and thirteen years." This would make thirty-three years, but in fact he ruled Norway for about nineteen years, 976–995.

27 34. *Gundhild.* Sister to Harald Blaatand and mother of "the Ynglings," who were the cause of much trouble before Hakon Jarl assumed control. Her name has become tarnished because of the wickedness of her sons; Graafeld is the most famous of these.

27 35. *Jomsborg's fight.* See *Introductory Note* on Hakon Jarl.

30 36. *The Wendish sceptre.* The Wends are a tribe of the Slavic race living in Saxony and Prussia. In his youth Olaf visited these parts and married a daughter of the Wendish king. After three years his wife died and Olaf went away in sorrow. Later, he was married to a daughter of the king of Dublin.

30 37. *Throndhiem.* A town and district on the west coast of Norway. At the time of the play this seems to have been the principal district, politically.

32 38. Historically this is not correct; Olaf did not set out with the intention of aiding Russia. It is the poet's reason for getting Olaf to Norway.

PAGE NOTE

32 39. *Garderike.* A Russian city, seemingly where the royal family dwelt at that time.
33 40. *The silent, awe-inspiring feast.* The Holy Communion.
35 41. *Syn.* Doorkeeper in Freia's hall, and guardian of the truth.
36 42. *Loke.* God of destruction and evil.
40 43. *Thrudvang.* The abode of Thor.
48 44. *Rogaland.* The ancient name of the present district of Stavanger.
48 45. *Baldur.* God of sunshine and happiness.
49 46. The following paragraph should be compared with the myth of Ygdrasil, the "Tree of the Universe." (See note 66, below.)
50 47. *Hakon Athelstein,* 'The Good.' The illegitimate son of Harald Fairhair and foster-son of King Athelstan of England. He attempted to christianize Norway but failed; he was forced to partake of the heathen rites as is stated below. At last he was killed on the island Stord by the sons of Erik Bloodax or "Gundhild's sons."
54 48. *Helheim.* The abode of Hel, the goddess of death.
56 49. *Dark Elivagar.* The Elivagar were the icy and poisonous streams that flowed out of Niflheim, the world of fog and mists.
58 50. *Griffin.* A fanciful creature, half lion and half eagle, found in Persian sculpture and on Greek coins and ornaments and in heraldry. It is an emblem of vigilance.
60 51. *Valfaudur.* The same as All-father.
63 52. *Bishop Popo.* He was sent by Otho II of Germany to Denmark to baptize King Blaatand and others. Hakon was one of these, and at the baptism was made to promise that he would introduce Christianity into Norway; but he broke his oath as soon as was possible and worshiped the ancient gods.
63 53. *The red-hot iron glove.* This was one of the tricks, or presumed miracles, that the early missionaries performed in order to persuade the people.
63 54. *Mistiness.* The 'southern' religion is often spoken of in such terms as 'dampness' and 'mistiness.'
63 55. *Thor's hammer.* See note 6, above.
64 56. *Skaerdingstad.* This and the other names in this paragraph, both persons and places, are mere local names and of no historical value.
64 57. *Erland.* No historical mention of Erland and the incident here related seems extant. It is, perhaps, the poet's invention.
66 58. *Aegir.* God of the sea, especially of the stormy sea.
66 59. *Ydun.* Keeper of the apples which the gods ate when they grew old, and which renewed their youth. Once Loke stole from her these apples.
66 60. *Asa-Tyr.* The god of war, who lost his right hand by putting it into the mouth of the Fenris-wolf, when the gods attempted to chain the latter.
66 61. *Followed Baldur down to deepest hell?* This refers to Odin's visit to Helheim, where he went to see what had become of Baldur, after the latter had been killed by the tricks of Loke.
67 62. *Ran.* Goddess of the sea, wife of Aegir.
67 63. *Auk-Thor's vain.* The constellation, the Great Bear.
67 64. *Saga.* Goddess of history. The meaning here is not clear. There seems no reason why Hakon should invoke the forgiveness of this goddess.

PAGE NOTE

68 65. *Skuld.* One of the three Nornes or Fates, Urd, Verdanda, and Skuld (the Present, Past, and Future). They control the lives of men, and their decrees are irrevocable. They are seated under Ygdrasil, the "Tree of the Universe."

68 66. *Ygdrasil.* The great ash tree that binds together heaven, earth, and hell. It stands upon the earth, but its branches reach into heaven and its roots penetrate hell.

68 67. *Urdur* or *Urd.* (See note 65 above.)

69 68. *Thorgierdur Horgabrud.* A local war-goddess, a special patroness of Hakon's. He calls upon her again at the end of this act.

70 69. *Auden.* This one-eyed man Auden can hardly be explained as a real personality. He must be considered as the Mephistopheles of Göthe or the 'other-world' beings of Shakespeare. Here he represents the conscience of Olaf in its last struggle to find out whether or not he is right in destroying the old religion of the North and planting in its place the Christian faith of the South.

73 70. *The Siren's song.* Tangbrand is of course acquainted with the South and its literature, and here refers to the sirens of Greek mythology.

76 71. *Mimer.* The keeper of the waters in the well of wisdom, where Odin had pawned one of his eyes for a drink. The *Elder Edda* says:

"Full well I know
Great Odin, where
Thine eye thou lost;
In Mimer's well,
The fountain pure,
Mead Mimer drinks
Each morning new,
With Odin's pledge."

77 72. *Askur.* Askur and Embla were the first man and woman that the gods created.

79 73. *Heimdal.* Keeper of the rain-bow bridge, Bifröst. He has a trumpet called Gjallarhorn which he blows in summoning the gods at Ragnarök, the doomsday. Here Hakon interprets the crowing of the cock as a signal from Heimdal for action.

80 74. *Nither.* Nither is not mentioned in the Eddas, but is a giant spoken of by Saxo Grammaticus, a Danish historian and author of the thirteenth century.

80 75. *Mere Amazons, mere Valkyrs.* The Amazons and Valkyrs were battle-nymphs who were present in battle at every warrior's side. They designated those who were to fall in battle, and later conducted them to Valhal. They are often called Odin's handmaids.

80 76. *Heimdal's temples.* See note 73 above.

81 77. *Thorgierdur Horgabrud.* See note 68 above.

85 78. *Gaulaa.* According to history, Gaulaa is where Hakon was killed.

89 79. *Restrained his hand.* The Bible reference here is plain.

92 80. *The doughty Jarl was slain.* This is historically true. Harald Graafeld and Erling, sons of the famous Gundhild, burned Sigurd Jarl, Hakon's father, in his own house.

93 81. *Hakon.* Hakon Athelstein. See note 47 above.

96 82. *Then it must be thou.* See *Introductory Note* on Hakon Jarl.

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# I.—*On the Crises of 1837, 1847, and 1857, in England, France, and the United States: An Analysis and Comparison*

BY IRA RYNER

Attractive as is the theory that commercial crises are abnormalities interrupting and retarding normal progress, the universality and regularity in occurrence of these phenomena have led us to adopt the contrary view as a working hypothesis. While the scope of our imagination permits the conception of an ideal society with organizations so nicely adjusted as to eliminate every possibility of irregularity, this ideal, though highly desirable, falls so far short of actual realization as to be impracticable as a standard. The question which concerns us is not the possibilities in an ideal society, but whether or not, given a certain degree of social progress, these periodical commercial disturbances are inevitable. If it is impossible to avoid them, the presumption at least is established that they are supplemental to progress. That for the past century and more these economic disturbances have occurred with persistent regularity and unchanging severity in all parts of the commercial world, we regard as evidence of their functional nature.

Further evidence of this functional nature appears upon learning that the crisis is not a cause or positive force, but a result. To illustrate, take the English crisis of 1847. Unquestionably the original cause of this crisis was an over-investment in rail-

way enterprises. To put it in the concrete, the amount of capital invested in railways was out of proportion to the amounts devoted to other industrial enterprises. Now what part did the crisis play? It must have come in simply as a reaction from an over-stimulation in a certain branch of industry. Capitalists and investors, overestimating the future demand for transportation facilities, continued to launch railway enterprises until the supply exceeded the demand. A readjustment or crisis was the inevitable result.

The statement that the crisis is the result of erratic business tending to establish its normality may be objected to, since the very opposite inference may be drawn. But the reply can be made that history affords abundance of evidence that human nature is such as to be subject to extremes, and that there are bound to be periodical outbursts of speculative fervor. It is an established fact that capitalists and investors do speculate to extremes and that they do invest until the supply exceeds the demand. But this evil seems to be one against which human ingenuity is powerless. In fact, it seems to be a part of human nature to go to such extremes. The only practical solution which offers itself is to evolve a new man with foresight sufficiently keen to see the approaching calamity in time to steer clear of it. But it is very evident that that man is not the normal business man of the present nor of the past, but of a future ideal society with which at present we have nothing to do.

In fact, the crisis is much more complicated than would appear from the illustration given. Instead of confining itself to one branch of industry, speculation may spread from industry to industry until it has practically involved the whole industrial field. A disproportion of investment in one field of industry or in several, or a disproportion between the total of circulating and the total of fixed capital may result.

With this as a working hypothesis, then, that the crisis is supplemental to the normal social movement, we take up the study of the three crises periods: 1836–39, 1847–48, and 1857.

In this study of crises, we shall treat the movements chronologically, taking up each cause for consideration in the order in

which it comes into operation as we proceed from a period of prosperity to one of depression.[1] For this purpose the following headings will be found convenient:

1. Changes in the permanent environment, or long-time causes.
2. Occasions, or short-time causes.
3. Trade movements.
4. Financial operations.

By changes in the permanent environment, or long-time causes, we mean those alterations in the environment that are of a lasting nature, i. e., those which survive the crisis. Railways constructed previous to the crisis and remaining in use for years afterwards come under this heading. Permanent extension of crop areas also comes under this class. Occasions or short-time causes are those forces which apparently cause the crisis. They are of short duration. In fact, they spring into existence during the period of speculation and perish with the crisis. Excess of railways and crop areas beyond the needs of the times, wars, crop failures, etc., fall under this heading. Strictly speaking, however, wars and crop failures should not be contrasted with long-time causes, as they are not characteristic of crises and are not so fundamental as the other kinds of occasions. The trade movements are international movements of merchandise, gold, and securities. Here it is the purpose to study not so much the general as the particular movements, or rather changes in the normal movements resulting from and indicative of the operation of either long-time causes or occasions or both. In considering financial operations, we pass from the materialistic environment to the highest psychic realm in economic activity—that of banking, private and government financiering, etc. The forces here in action are given a stimulus by the movements in the material environment, and in turn they react upon it, so that the actions and reactions form a complete circuit. We shall treat first the permanent environmental changes of each crisis.

[1] We have taken the ideal way. A crisis movement may actually start within a financial operation, or a trade movement, the permanent environment being acted upon later.

## I

### CRISIS OF 1837

Preliminary to the discussion of permanent environmental changes, it may be well to point out the difficulty encountered in determining exactly, in a particular change of environment, for example railway extension, how much is permanent and how much occasional. The course we shall pursue is that of treating the whole change as permanent, where classification is difficult, in the treatment of the first heading. In the discussion of the second heading, however, we shall attempt to measure approximately at least how much of the change is occasional.

A few years previous to the crisis of 1836–39 the first railroads were constructed. This revolution, resulting in the annihilation of space and time, naturally caused an overestimation of the immediate needs for railway facilities, and the speculation beginning here soon spread to other industries. In England, railway construction began about 1830. By 1838, there had been constructed 490 miles at a cost of £13,300,000.[1] The speculation spread to joint-stock banking, and it is estimated that between 1834 and 1836 about seventy banks were established.[2] Thus the mania spread from business to business until, during the two years just preceding the crisis, 300 companies with a capitalization of £135,248,700 were formed. Of this whole amount £69,000,000 were for railway enterprises and £23,000,000 for joint-stock banks.[3]

As an indication of the variety of purposes for which companies were formed we quote a list from Juglar, the titles of which are significant: "The British-Agricultural Loan company, another for supplying pure spring water, the Patent Steam Paddle company, the Safety Cabriolet company, the British and American Intercourse company, the London Whale Fishery company, the Liverpool British and Foreign Trading company."[4] In

[1] Levi, *History of British Commerce*, 302.
[2] Crump, *The Key to the London Money Market*, 29.
[3] Levi, *History of British Commerce*, 220.
[4] Juglar, *Les crises commerciales*, 345.

addition to these, there were mining companies, insurance companies, investment companies, newspaper companies, canal companies, gas companies, etc.[1] The heaviest investment, however, as shown by the figures above, was in railways and joint-stock banks.

Finally we can sum up the period just preceding and a few years succeeding the crisis as forming an important part of an era of great industrial change. England was changing from an agricultural to a commercial nation. At the beginning of the century, the iron mines were turning out annually about 200,000 or 300,000 tons of pig iron. In 1835, the output was a million; in 1844 it had jumped to a million and a half. "The quantity of coal shipped had risen from four millions and a quarter in 1819 to over nine million tons in 1844." Changes in the processes of manufacture of cotton and woolen goods had drawn labor from other pursuits. "In 1831, out of a population of 16,500,000, 1,243,000 adults were employed in agriculture. In 1841, out of a population of 18,750,000, 1,200,000 only were so employed."[2] The first half of the century was a period of industrial transformation for England, and the period under consideration was perhaps the most critical point.

That this was a critical point is shown by the intense conflict which arose over the corn laws, finally resulting in their abolition, in the decade 1840–50. England, in spite of her artificial barriers against foreign grain, was losing her unique position as a self-sufficing nation, as shown by the increased wheat importations. From 1819 to 1836 wheat imports were relatively small, the largest annual importation being that of the year 1830 of 1,700,000 quarters. But from 1839 to 1842 imports averaged 2½ million quarters; in 1843 and 1844 nearly a million; in 1845 they fell to 315,000 but rose again in 1846 to 3,000,000, and in 1847 to over 4,500,000 quarters.[3]

[1] Levi, *History of British Commerce*, 220.
[2] Sydney Buxton, *Finance and Politics*, I, 72, 73.
[3] Porter, *Progress of the Nation*, 137–38.

IMPORTS OF WHEAT

| *Years* | *Quarters* | *Years* | *Quarters* |
|---|---|---|---|
| 1825 | 525,231 | 1835 | 28,483 |
| 1826 | 315,892 | 1836 | 24,826 |
| 1827 | 572,733 | 1837 | 244,087 |
| 1828 | 842,050 | 1838 | 1,834,452 |
| 1829 | 1,364,220 | 1839 | 2,590,734 |
| 1830 | 1,701,885 | 1840 | 2,389,732 |
| 1831 | 1,499,631 | 1841 | 2,619,702 |
| 1832 | 325,435 | 1842 | 2,977,301 |
| 1833 | 82,346 | 1843 | 982,286 |
| 1834 | 64,653 | 1844 | 1,026,690 |

With the exception of the few years of extraordinarily abundant harvests from 1832 to 1836, the distress arising from the operation of the corn laws was growing. England was clearly destined to become a commercial nation. The conflict over and final abolition of these laws afforded evidence that an industrial change was taking place.

In France the movement for permanent investment was less pronounced. This was due, perhaps, as Juglar contends, to the lack of surplus capital resulting from the internal disorders in which France found herself at this time. Nevertheless, according to good authority, rapid changes were taking place here as well as in England. Lavisse and Rambaud say: "C'est pendant la période qui s'étend de 1815 à 1848 que s'accomplit en France la substitution du régime de la grande industrie au régime de l'industrie domestique qui avait dominé jusqu 'alors. L'application, pendant les dernières années de l'empire des nouvelles inventions mécaniques, importées de l'Angleterre, à la filature et au tissage du coton, a marqué les débuts de cette transformation."[1]

That cotton and woolen manufactures were booming is seen by a glance at export statistics. From 1833 to 1840 the total value of French exports increased by £10,000,000.[2] During the same period the value of cotton exports increased by over £2,000,000 and that of woolen exports by almost £1,000,000. Thus,

[1] Lavisse et Rambaud, *Histoire générale*, X, 440.
[2] Porter, *Progress of the Nation*, 411.

manufactured cotton and woolen goods constituted almost one-third of the gain in the value of exports for this period.

In agriculture, France seems to have been gaining rather than losing, although the introduction of improved farm machinery appears to have been very slow. In 1812 Chaptal valued the total agricultural product at three milliards of francs. In 1850 L. de Lavergne valued the product at five milliards, a gain of 60 per cent.[1] For the same period the population increased from 29,000,000 to 35,000,000, an increase of about 20 per cent.[2] While this computation is not accurate nor confined to the particular period under consideration, it nevertheless gives a clue to the general trend of affairs.

As to the nature of French permanent investments for this period, we find them confined principally to enterprises connected with literature. From 1826 to 1838, of the 1,106 companies formed, 401 related to journals, periodicals, and books, 95 to manufactures, 93 to coaches and modes of conveyance, and 40 to banks.[3] The conclusion, however, that there was a preponderance of investment in literary enterprises must be modified because of the fact that each literature company requires a relatively small amount of capital.

Turning now to the United States, we find a state of affairs similar to that in England. The country was passing through a stage of invention and permanent improvement. This movement of advance was greatly aided by enormous investments of foreign capital. The fact that from 1832 to 1835 our public debt had been reduced from 24.3 millions to .037 millions had rendered Europeans overconfident as to the soundness of American finance and the stability of American industry.[4] From 1832 to 1839 the railway mileage increased from 229 to 2,302.[5] That there was a large demand for rails is suggested by the rise of iron prices in England. The opening up of western territory and

[1] Lavisse et Rambaud, *Histoire générale*, X, 450.
[2] *International Encyclopedia*, VI, 204.
[3] *Journal of the Statistical Society of London*, I, 85.
[4] Sumner, *History of American Currency*, 128.
[5] *United States Statistical Abstract*, year 1902.

Furthermore, England was at this time greatly extending her trade. A new and valuable market had been opened up in China. There was a renewal of commercial intercourse with the United States and also operations with the Continent were multiplied.[1] Of course these may be classed under either permanent or short-time causes according to the permanency of the influence.

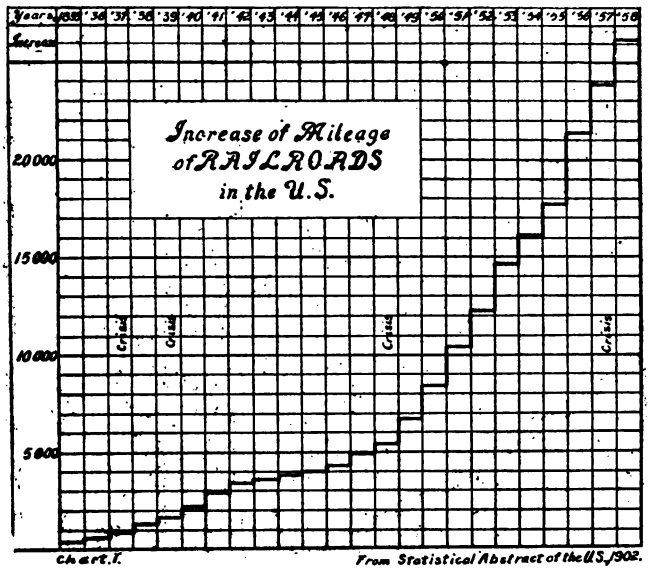
The excessive optimism of the times characterized the government as well as private investors. As evidence of this we have parliament making provision that after a certain time the maximum railway dividends should be 10 per cent; in case of excess it was to be lowered by the government reducing the fares, tolls, etc.[2]

Cheap iron and abundance of surplus capital had in France as in England resulted in extensive railway investment. To this may be added the fact that in 1842 the construction and management of railways were turned over to private corporations, although railways might still and in fact did receive assistance from the government. Finally we note that this period was a continuation of the era in which introduction of improved farm machinery and improved processes of manufacture took place.[3] According to Juglar, there is a very close resemblance between the crises of 1847 in England and France.

In the United States, however, we have an entirely different state of affairs. Here several forces were in operation to ward off the crisis which convulsed Europe. There was not the abundance of capital that was to be found in Europe. Juglar contends, and the point seems to be well taken, that the crisis 1836–39 extended over too far to permit the accumulation of much capital by 1847.[4] Furthermore, from 1846 to 1848 we were engaged in war with Mexico, costing us something like $64,000,000.[5] As evidence of the absence of a railway mania in the

[1] Crump, *The Key to the London Money Market*, 31.
[2] Levi, *History of British Commerce*, 303.
[3] Lavisse et Rambaud, *Histoire générale*, X, 440–42.
[4] Juglar, *Les Crises Commerciales*, 468.
[5] Dewey, *Financial History of the United States*, 225.

United States we observe that the number of miles of railway in operation increased only from 4,185 in 1843 to 5,996 in 1848.[1]




In this crisis Europe experienced a marked advance in railway construction. There was also a noticeable increase in joint-stock banks and an extension of the market area in England. In the United States the partial dearth of capital, resulting from an undue prolongation of the period of depression following the preceding crisis, and a costly war robbed the crisis of its material.

## CRISIS OF 1857

The crisis of 1857 in England, unlike that of 1847, seems not to have been characterized by excessive investment in any particular branch of industry. True, the railway mileage increased from about 7,000 in 1851 to 11,000 in 1861,[2] but this increase can hardly be regarded as representing an outlay of capital out

[1] *Statistical Abstract United States*, 1902.
[2] Levi, *History of British Commerce*, 307.

of proportion to the amounts devoted to other enterprises. In spite of an expenditure of £70,000,000, £36,000,000 of which was raised by immediate taxation, for the Crimean war of 1855–56, the country had an abundance of capital and was in a state of rapid general advancement.[1]

Production of all kinds was increasing rapidly. From 1852 to 1858 the production of coal increased from 34,000,000 to 65,000,000 tons as shown by the following table:[2]

| | | | |
|---|---|---|---|
| 1852 | 34,000,000 | 1856 | 66,645,450 |
| 1853 | 54,000,000 | 1857 | 66,394,707 |
| 1854 | 64,661,401 | 1858 | 65,008,649 |
| 1855 | 64,453,070 | | |

The production of pig-iron increased from 2,000,000 tons in 1847 to 3,586,377 in 1857 as shown by the table:[3]

| | | | |
|---|---|---|---|
| 1847 | 1,999,508 | 1857 | 3,659,447 |
| 1852 | 2,701,000 | 1858 | 3,456,064 |
| 1854 | 3,069,838 | 1859 | 3,712,904 |
| 1855 | 3,218,154 | 1860 | 3,826,752 |
| 1856 | 3,586,377 | | |

The production of wheat was a trifle above the average on account of exceptionally good harvests, but of course since the abolition of the corn laws in 1846–49 we naturally expect England's wheat production to decline in amount and importance.

That England, as in the period preceding the crisis of 1836–39, was still further losing her position among the agricultural nations is shown by the following table of percentages of population engaged in the different occupations:[4]

| *Occupation* | *1851* | *1861* |
|---|---|---|
| Agriculture | 20.9 | 18.0 |
| Fishing | 0.2 | 0.2 |
| Mining | 4.0 | 4.5 |
| Building | 5.5 | 5.8 |
| Manufactures | 32.7 | 33.0 |
| Transportation | 4.1 | 4.6 |

[1] Buxton, *Finance and Politics*, 155.
[2] *Monthly Summary of Commerce and Finance*, April, 1900.
[3] Swank, *Iron in All Ages*, 520.
[4] *Royal Statistical Society of London*, XLIX, 324.

It will be noticed that all occupations given in the table except fishing and agriculture gained. Agriculture is the only occupation suffering an actual loss.

A general expansion is clearly indicated by the large trade movements. From 1848 to 1856 the value of English exports increased from £58,850,000 to £115,890,000, although the permanent surplus of imports begins at about the latter date.[1] That cotton figured largely in the trade expansion is shown by the accompanying statistics on cotton imports and exports:[2]

| | *Raw cotton imported* | | *Value of cotton yarn and manufactures of all descriptions exported* |
|---|---|---|---|
| 1840 | ..... 592,000,000 lbs. | 1830 | .....£19,428,000 |
| 1850 | ..... 685,000,000 lbs. | 1850 | .....£28,257,401 |
| 1860 | .....1,390,938,752 lbs. | 1860 | .....£52,912,380 |
| 1870 | .....1,338,365,584 lbs. | 1870 | .....£71,410,131 |
| 1880 | .....1,628,664,576 lbs. | 1880 | .....£75,564,887 |
| 1885 | .....1,425,816,336 lbs. | 1885 | .....£70,796,885 |

It will readily be observed that the decade 1850–60 is the period of most marked advance in the cotton trade. Incidentally it may be of interest to note that in 1860, of the 1,390,938,752 pounds imported into England, the United States supplied no less than 1,115,890,608 pounds.[3]

The English crisis has been characterized by some writers as a monetary panic, but, whatever be the technical term applicable, it is quite obvious that this crisis differs radically from that of 1847. This time a disproportion of investment in one or a few branches of industry seems not to have been the trouble. The permanent cause of disturbance seems rather to have been a disproportion between the total amounts of fixed and circulating capital. There was too much capital tied up in permanent investments.

It was now the turn of the United States to have a railway crisis. As a result of the escape from a crisis in 1847, a great accumulation of capital had been taking place. Added to this,

[1] *Monthly Summary of Commerce and Finance*, February, 1903.
[2] Ward, *The Reign of Queen Victoria*, II, 158.
[3] *Ibid.*, 193.

foreigners were again investing in American enterprises, it being estimated that England alone had something like $400,000,000 so invested.[1] From 1848 to 1859, the number of miles of railway in operation increased from 5,996 to 28,789.[2] That this increase was excessive may be demonstrated by the fact that statistics fail to show anything like a corresponding rate of increase either immediately before or after this period.

Several factors contributed to the impulse given to railway construction. Our production of coal was increasing rapidly. According to Mulhall, the state of Pennsylvania alone from 1830 to 1850 constructed seven canals and twenty-seven railroads for the express purpose of transporting coal. The following table shows the increase in coal production:[3]

| *Year* | *Tons* | *Year* | *Tons* |
|---|---|---|---|
| 1851 | 4,448,916 | 1855 | 6,608,567 |
| 1852 | 4,993,471 | 1856 | 6,927,580 |
| 1853 | 5,195,151 | 1857 | 6,644,941 |
| 1854 | 6,002,234 | | |

The production of pig iron increased from 563,775 tons in 1850 to 712,640 in 1857.[4] There was also an increased demand for transportation facilities to move agricultural products. Cotton production especially demanded more ample means of conveyance as shown by the table:[5]

| *Year* | *Bales* |
|---|---|
| 1840 | 2,177,835 |
| 1850 | 2,337,718 |
| 1860 | 4,861,292 |

That of 1860 was the highest production previous to 1879, and it is to be noticed that the rate of increase for this decade was decidedly higher than in the preceding decade. There was also an enormous increase in wheat production, as the following table shows:[6]

[1] Sumner, *History of American Currency*, 170.
[2] *Statistical Abstract of the United States*, year 1902.
[3] *Monthly Summary of Commerce and Finance*, April, 1900.
[4] *Ibid.*, August, 1900.
[5] Burton, *Crises and Depressions*, 294.
[6] *Statistical Abstract of the United States*, year 1902.

PRODUCTION

| *Year* | *Bushels* |
|---|---|
| 1840 | 84,823,272 |
| 1850 | 100,485,944 |
| 1860 | 173,104,924 |

EXPORTS

| *Year* | *Wheat, bu.* | *Flour, bbl.* |
|---|---|---|
| 1850 | 608,661 | 1,385,448 |
| 1851 | 1,026,725 | 2,202,335 |
| 1852 | 2,694,540 | 2,799,339 |
| 1853 | 3,890,141 | 2,920,918 |
| 1854 | 8,036,665 | 4,022,386 |
| 1855 | 798,884 | 1,204,540 |
| 1856 | 8,154,877 | 3,510,626 |
| 1857 | 14,570,331 | 3,712,053 |

In connection with a study of the decline of agriculture in England, it may be of interest to observe the tendency in the United States. For this purpose the following table will be useful:

| CEREAL PRODUCTION | | | MANUFACTURES | | |
|---|---|---|---|---|---|
| Year | Bushels per capita | Increase % over quantity for preceding decade | Year | Capital invetd. increased % during decade | Net products increase % |
| 1839 | 36.06 | ..... | 1850–60 | 89.38 | 84.11 |
| 1849 | 37.40 | 40.93 | 1860–70 | 67.80 | 63.31 |
| 1859 | 39.41 | 42.84 | 1870–80 | 64.10 | 40.01 |
| 1869 | 35.98 | 11.97 | 1880–90 | 120.78 | 106.59 |
| 1879 | 53.78 | 94.45 | | | |
| 1889 | 56.19 | 30.44 | | | |

The table shows that for this particular decade manufactures with regard to product had the better of the situation. In the decade 1870–80, however, the situation is just the reverse, while in the decade 1880–90 manufactures again had the upper hand.

Summarizing: The crisis of 1857 in Europe was characterized by speculation and over-investment in general. In the United States, while there was a general change in the permanent environment, decidedly the most marked advance was in railway construction.

## II

### CRISIS OF 1836–39

Turning now from long-time to short-time causes, we encounter such a complication of actions and reactions between these two kinds of forces as to render it frequently quite difficult to determine the category to which a certain force belongs or even to confine it to a single category. To illustrate: A portion of increased railway mileage may be permanent and another portion temporary or occasional. Again, railway extension may increase loans; and loans upon favorable terms, on the other hand, may encourage railway extension. Whenever possible, however, we shall adhere to the classification given in the introduction.

In England the cause of the crisis of 1836–39 is attributed to deficient harvests at home and to certain financial measures taken by the United States. The crop of 1838 is reported as the worst since 1816 and that of 1839 was but little better.[1] The "corn" crop was deficient, and there was as a result an import of £10,000,000 worth of wheat for the year 1838 alone.[2] The issue of the specie circular as part of an attempt to place the American currency upon a metallic basis drew gold from Europe. Some American students of crises say, however, that the trouble started in England; that England had over-expanded, a reaction followed which cut off the demand for American cotton, thus resulting in ruin to that and to other industries in the United States.[3]

The weight of the argument, however, seems to be in favor of the former view. For six or eight years the imports by the United States from England had greatly exceeded her exports, which shows that we were getting credit abroad in the shape of security sales, time operations, etc.[4] Now this would certainly render England decidedly sensitive to every change in the course of events in the United States. The operation of the specie cir-

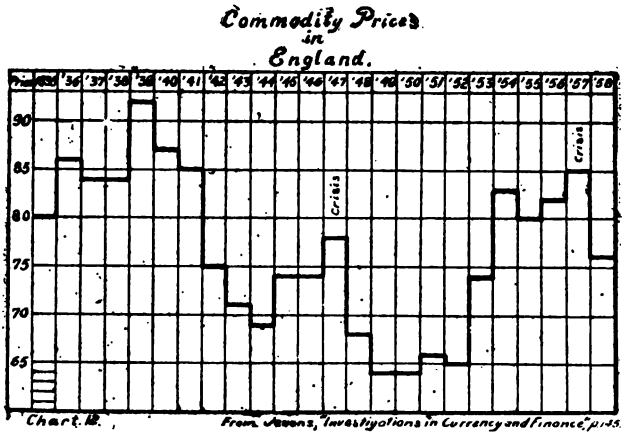
[1] Macleod, *A History of Banking in all the Leading Nations;* vol. II, *A History of Banking in Great Britain*, 134.

[2] Juglar, *Les Crises Commerciales*, 347.

[3] Sumner, *History of Banking in the United States*, X, 268.

[4] *Monthly Summary of Commerce and Finance*, year 1903.

cular immediately caused suffering in the United States and drew gold from Europe. Here it would seem we have located a most natural starting point. There were evidences of an impending crisis immediately upon the issuance of the specie circular. Furthermore, there were no short-time causes sufficient to bring on a crisis in operation in England at that time; the crop failures did not come until two or three years later.




In France the movement was simultaneous with that in England, and it is probable that both countries alike were affected considerably by the drain of gold from Europe to the United States. The crisis in France, however, as mentioned before, was much less severe than in England. The most significant occasion, perhaps, was the superfluity of literary companies.

In the United States poor crops prevailed in 1834–35, while for these same years there were good harvests in Europe.[1] But besides bad crops there were other conditions favorable to a crisis. In addition to the great increase in the number of banks, which we observed in our study of the permanent environmental changes, there was the further fact that they were doing business on a decidedly unsound basis. In the United States Bank, sup-

[1] Dewey, *Financial History of the United States*, 230.

posedly the strongest of all, for the year preceding March, 1837, the loans on stocks and other than personal security had increased $7,821,541, while bills discounted on personal security and domestic exchange had actually decreased $9,516,463. The Girard Bank of Pennsylvania had a discount line of six or seven millions, with scarcely two hundred thousand dollars in active business paper.[1] Banks in general were in a very unsound condition.

It is here in connection with banking that we have a typical case of complicated action and reaction between causes and occasions. The rapid launching of new railway enterprises, the extension of the cotton area, and the sale and improvement of western lands created a demand for increased banking facilities; while, looking at the phenomenon from the other side, we see that increased banking facilities would have a very strong tendency to encourage new business undertakings. There was undoubtedly such a series of reciprocal influences that neither of the phenomena could be termed pure cause or pure result.

That a part of the banks founded constituted an occasion is evidenced by the fact that there was a maximum number of banks during the crisis period as shown by the following table:[2]

| | | | |
|---|---|---|---|
| 1829 | 329 | 1839 | 840 |
| 1834 | 506 | 1840 | 901 |
| 1835 | 704 | 1841 | 784 |
| 1836 | 713 | 1842 | 692 |
| 1837 | 788 | 1843 | 691 |
| 1838 | 829 | 1844 | 696 |

In other words, a considerable surplus of banks was formed, which were beyond the normal need of the times and destined not to become a part of the permanent environment.

July 11, 1836, the specie circular was issued. It abolished the system of credit land sales and provided that all payments for land be made in specie. For the moment it checked the impulse for speculation and aggravated the money stringency which had already begun to be felt. As early as April, 1836, best New York commercial paper was quoted at 30 and 40 per cent per

[1] Sumner, *History of Banking in the United States*, 226.
[2] Dewey, *Financial History of the United States*, 225.

annum.[1] The alarm spread to England and, coupled with an increasing export of gold, produced a rise in the English bank rate. A reaction naturally followed, with a suspension of a considerable number of banks in the United States; bank-notes lost from 10 to 20 per cent, and exchange on France and England rose to 22 per cent.[2]

The distress arising from this money stringency was greatly aggravated by frauds practiced upon the public by promoters and schemers. In several cases the promoters were men holding offices of public trust. In this category Biddle, president of the United States Bank, is placed by some authorities. But whether or not his intent was to defraud the public, his operations were at least speculative and as such are of interest as indicative of the speculative spirit of the period, even if we can not class them under frauds.

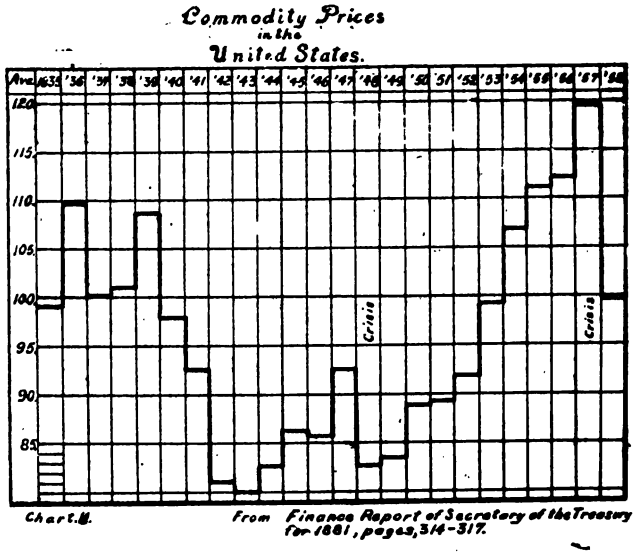
Biddle attempted, and for a limited time succeeded in cornering cotton. Formerly it had been the custom for the bank to assist the planters by exchanging bank-notes for bills of exchange. By this means the merchants could pay the planters and the planters in turn could pay the country merchants. Biddle contended that because private credit was at this time practically worthless it would not be safe to pursue the customary plan, and proceeded to buy up directly the whole visible supply of cotton. For this purpose he secured the services of special agents, one of whom he sent to England to represent him in the English markets. He also entered into negotiations with several strong European houses to assist him in establishing the monopoly. When the banks in the South began to run short of funds and to lose their hold on the confidence of the people, he came to their rescue by exchanging United States bank-notes for their bonds. By this means the entire supply of cotton was bought up and the price kept at a high level.

The modus operandi of Biddle's scheme was simple. He bought cotton in the United States with depreciated paper and

[1] Sumner, *History of Banking in the United States*, 264.
[2] Juglar, *Les Crises Commerciales*, 462.

sold it in Europe for gold. While the operation lasted it provided a stimulus to the cotton industry and produced an overextension of credits. According to Juglar, in 1838 there had been $20,000,000 loaned to southern planters.

Finally, however, when the monopoly had been carried to its utmost limit, when cotton factories began to close down, and when the European houses, realizing the impracticability of a complete monopoly, refused to invest any more capital in cotton, the crash came. Immediately the price of cotton fell and a panic was precipitated.[1]




Whether or not Biddle's operations in cotton brought on the panic of 1839 unaided by other causes is a question not easily answered. It is more probable that the liquidation after the panic in 1837 had not been complete and that a second was scheduled by the natural order of things. It is certain, however, that the cotton monopoly aggravated an already bad condition and was the direct cause of the reaction which spread from the United States to England and from there to the Continent.

[1] Sumner, *History of Banking in the United States*, 294-301.

The loss entailed by the two panics of 1837 and 1839 in the United States was enormous, considering the rather primitive stage of our economic development. Juglar estimates that there were no less than 33,000 failures involving a loss of something like $440,000,000.[1]

## CRISIS OF 1847

In 1847 in England we have a great railway crisis. The fundamental change in permanent environment was the rapid extension of the railway mileage. The principal occasion, in addition to excess of railway construction, was the deficient harvest preceding the crisis. In 1846 the Irish potato crop was almost a complete failure. So great was the calamity that England was forced to grant relief to the extent of several million dollars. The total loss occasioned by the famine has been estimated at £13,000,000.[2]

In addition to the potato famine there was also a deficiency in the supply of grain. The supplies on hand in England were small and the harvests on the Continent did not give their usual yield. As a result we find England in the year 1846 importing 3,814,666 quarters of grain and 4,356,812 cwts. of flour and meal.[3] The wheat crop of 1846 is estimated as the worst since 1841. We also get an indication of the increased demand for grain and flour in Europe from a study of United States export statistics. In 1845 we exported only 1,195,230 barrels of flour. In 1846 the export of flour had risen to 2,289,476 barrels, while in 1847 it jumped up to 4,382,496, which mark it did not again reach for a good many years. In 1848 it fell back to 2,119,393 barrels.[4] The reduction of import duties which began in 1842 may also have had some influence indirectly through trade balances upon the crisis.

France suffered the same crop failures, with the exception of potatoes, as Great Britain. According to Juglar, France had

[1] Juglar, *Les Crises Commerciales*, 467.
[2] Evans, *The Commercial Crisis of 1847–48*, 55.
[3] Crump, *The Key to the London Money Market*, 32.
[4] Juglar, *Brief History of Panics in the United States*, 14.

fully as severe a crisis as was experienced in England; and we find the Bank of France getting assistance from the Bank of England. The distress resulting from the crisis was continued through the revolution in 1848.

In the United States, as previously shown, the crisis was very slight and did not come until as late as 1848. The prolongation of the crisis of 1839 and the consumption of surplus capital in the Mexican war were strong forces working to avert the crisis. Furthermore, we were having fairly good crops, while in Europe they were deficient. One writer attributes what little distress we experienced to the cutting off of the demand for cotton as a result of the revolution in France.[1]

## CRISIS OF 1857

The crisis of 1857 is distinguished from the two preceding crises by the absence of any premonition of an approaching calamity. In England up to the very outbreak of the crisis business was apparently in a healthy condition. There were several political disturbances on the Continent—the intervention of Russia in Hungary, the French expedition to Rome, and the disturbances throughout Germany, not to speak of the war in the Punjaub,—but these could not be regarded as causes nor even signs of a panic.[2] The first crisis impulse came from the United States, and that not until six weeks after the movement had started there.

In the United States as in England the crisis was not preceded by any warning. The first alarm sounded was the actual failure on the 25th of August of the Ohio Life and Trust company, supposedly one of the soundest institutions in the country. By the 17th of October, 150 American banks had failed.[3] The crisis came suddenly, was very severe, and was notorious for bank failures.

If, however, we turn to trade and banking statistics we find conditions conducive to a crisis. Comparing the years 1857 and

[1] Balfour, *Merchants Magazine*, vol. XVIII, 477.
[2] Crump, *The Key to the London Money Market*, 33.
[3] Macleod, *History of Banking in England*, 159.

1849, the imports had increased 133 per cent, the bank capital 160 per cent, the bank loans 140 per cent, and the bank deposits 200 per cent.[1] Thus we observe that trade was expanding and that the banks were greatly extending their credit operations.

The principal loans had been made to railway companies. From January 5, 1856, to August 8, 1857, the banks expanded their loans from $95,000,000 to $122,000,000, most of which represented new railway projects. Soon, however, the banks pursued a policy of contraction, and from August 8, 1857, to October 10, 1857, the loans fell from $122,000,000 to $100,000,000.

The situation was rendered doubly bad because railway loans are necessarily long-time loans. As a result, when pressure began to be felt, the banks, knowing that their long-time debtors could not aid them on so short notice, began to call in short-time loans made to merchants. But the merchants, being in hard straits also, retaliated by organizing a run on deposits. The merchants were successful, and the bankers were forced to undergo the penalty for making excessive long period loans.[2]

Of the three crises embraced in this study, that of 1857 was undoubtedly the most severe. Its leading features, according to Sumner, were, "that it was world-wide, very sharp and sudden, and quickly over." Unlike the other two, there were no two or three distinct occasions in evidence to which the crisis could be attributed. Perhaps, however, in the case of Europe, the actual breaking out of the crisis in the United States may be regarded as an occasion. But the real source of the panic seems to have been a general expansion of business. Technically speaking, we might term it a case of disproportion between fixed and circulating capital. There was probably sufficient excess of investment simultaneously in many branches of industry to constitute an occasion. The crisis was the culmination of the operation of many occasions.

[1] Sumner, *History of Banking in the United States*, 425.
[2] *Ibid.*, 426–27.

## III

### Trade Movements

### crisis of 1836–39

Having made a study of the permanent environment and occasions, it is logically in order for us to treat next of trade movements. This appears to be the natural order since, as a rule, outside of tariff changes, changes in trade movements result from the operation of causes and occasions, as we have defined them.

To establish the truth of this assertion, let us take the case of England where, preceding the crisis, extensive improvements in manufacturing machinery made it possible to turn out cotton goods at greatly reduced prices. This of course stimulated the demand for raw cotton, resulting in an increased export of that article from the United States. To trace the effect farther, the increased trade extended the cotton area, boomed southern cities, encouraged the extension of the railway system, and so on.

Other industries, however, were undoubtedly affected unfavorably by these changes, since increased activity in cotton must have necessitated a withdrawal of capital from other industries, or increased loans, or both. Thus we see a change in one branch of industry may pass an impulse to another branch, the disturbance in this branch affecting another, and so on until the current of impulse has pervaded the whole industrial system. Nevertheless, although the increased export of cotton resulted in an extension of the cotton area, the real cause was the improvement of manufacturing machinery in England. Or we may go even farther back and say that high wages or some other causes rendered indispensable the improvement of machinery. So in general we may say that, although trade movements are indicative of the operation of causes and occasions, yet they are themselves not causes but results.

In England during the period from 1830 to 1837 the principal merchandise movement was in exports. The imports continued to increase at a constant rate, rising from $225,000,000 to $266,000,000. The exports on the other hand almost doubled in

amount, increasing from $239,000,000 to $417,000,000 for the same period. Previous to this period imports had been increasing at a more rapid rate than exports.[1] This increased export trade we would naturally expect of a manufacturing country experiencing extensive improvements in machinery during an era of general prosperity. It would also be natural to expect that increased imports of raw materials such as iron, wool, cotton, etc., would be accompanied by a more than corresponding increase in exports, manufactured goods being of less bulk and higher value.

In the United States, exactly the opposite process from that in England was taking place. Imports were increasing faster than exports. From 1830 to 1837 the excess of imports amounted to over $130,000,000, while at the same time there was a net import of specie of $34,000,000.[2] We were buying much more than we were selling, and also much more than we were paying for.

The phenomenon in the United States also is not difficult to explain. We experienced a slight increase in exports consisting principally of raw materials such as wool and cotton. We were not a manufacturing nation and, furthermore, were devoting all our energies to the internal development of the country. This situation was certain to result in an unfavorable trade balance, and that for two reasons: In the first place, if we were devoting our energies to internal improvements and speculative enterprises, we could not give the proper amount of attention to ordinary trade, especially manufacturing; hence no large increase in exports; in the second place, these home investments greatly increased the demand for all kinds of goods, consequently increased imports. From 1830 to 1837 imports increased from $62,000,000 to $176,000,000, almost trebling, while for the same period exports rose from $71,000,000 to $124,000,000, not quite doubling. Previous to this time exports and imports had increased at practically the same rate.[3]

[1] *Monthly Summary of Commerce and Finance*, February, 1903.
[2] *Ibid.*
[3] *Ibid.*

As illustrative of the statement that investment in speculative enterprises has a tendency to curtail exports we have a case cited by Professor Dewey. According to him, "the value of flour and grain imported into the United States as a rule was insignificant, while that exported after 1830 was on the average about six million dollars annually. In 1837, however, the exports of grain fell off nearly a million dollars, while the imports of grain were increased more than four and a half million dollars."[1] Thus, while previously to 1837 we have an insignificant import and large export trade in grain, in 1837 we have a falling off of exports and an enormous increase of imports.

Turning now to the gold movement, we find an efflux of the precious metals from England in 1833 and 1834 due, though not exclusively, according to Crump, to the loans made to Spain and Portugal.[2] During the slight panic of 1835, however, England recovered her gold. Just after the issuance of the specie circular in the United States gold began to leave for that country, and this outward movement continued until the early part of 1837, in spite of a rise of 1 per cent in the rate of discount. This movement of the precious metals is generally attributed to the money stringency in the United States occasioned by the attempt to place the currency on a specie basis.

During the whole of the year 1837 gold was continually pouring into England.[3] The crisis had broken out in 1836, and the country was now going through a process of liquidation preparatory, apparently, to a resumption of prosperity. The bank rate was lowered 1 per cent in February, 1838, and the reserve remained at a high level until the last month in the year. In December an export of gold began, and heavy outward shipments continued until the latter part of the next year, when the rate of discount was raised from 4 per cent to 6 per cent.[4] As a result of extensive cotton speculation on the part of the management of the United States Bank, a second crisis had broken out in the

[1] Dewey, *Financial History of the United States*, 226.
[2] Crump, *The Key to the London Money Market*, 29.
[3] Crump, *Ibid.*
[4] Seyd, *The Bank of England, Its Note Issue, and Its Error.*

United States which, with the low rate of discount in England, made it profitable to ship gold to America. With the raising of the bank rate and the passing of the crisis, gold began to return.

According to Juglar, England would not have suffered such severe losses of gold had she manipulated her bank rate properly. He contends that the crisis of 1839 was due entirely to the cotton speculation in the United States, and that the drain of gold could have been prevented by raising the rate of discount to the point where it would have rendered the shipping of gold to America unprofitable.[1] This point seems to be well taken, since our unfavorable trade balance would naturally be a good basis for a contrary movement of the precious metals.

Combining the movements of merchandise and gold, we find in the United States an excess of imports of both kinds of commodities, which is conclusive evidence either that Europe was investing in American securities or that she was granting credit on goods purchased, or both. According to all authorities vast amounts of American securities were being sold in foreign markets, and the low bank rate in England greatly facilitated the sales.[2]

In addition to this international extension of the credit system, there was also an increase of credit transactions within the different countries. In the United States for the year 1838 the North loaned the planters of the South $20,000,000.[3] The merchants in the North loaned or sold on time to the planters of the South, and the exporters of Europe loaned or gave credit to American merchants. Hence, when England refused to grant credit any longer to the United States, the North was forced to pursue the same policy with regard to the South, so that a general collapse of credit followed.

[1] Juglar, *Les Crises Commerciales*, 459–67.
[2] Sumner, Crump, Dewey, etc.
[3] Juglar, *Brief History of Panic in United States*, 70.

CRISIS OF 1847

In England previous to the crisis of 1847, on account of unfavorable exchanges, gold began to be exported June, 1845, and up to November of the same year the Bank had lost two and a half millions of bullion. But from the latter date until March of the following year, 1846, the movement was reversed, and during the whole year gold returned to England.

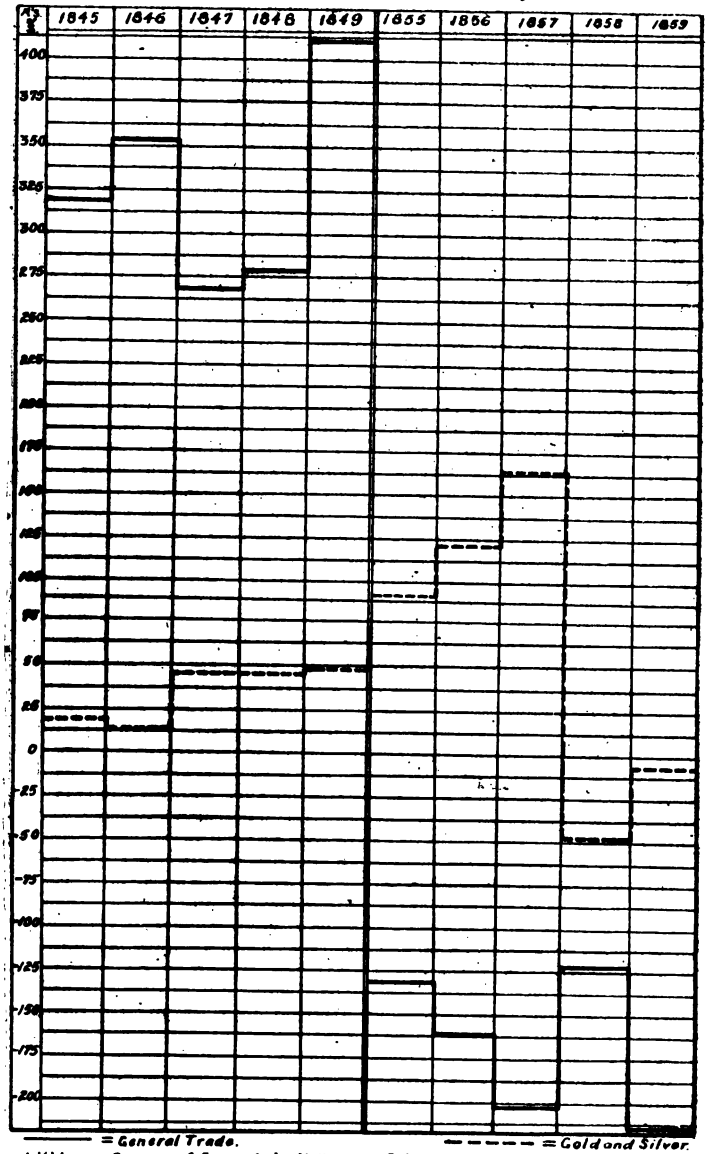
At the beginning of the year 1847, however, gold began to flow out again, and this movement continued throughout the whole year. By the 24th of April the reserve had fallen to a trifle over nine millions. The complete failure of the potato crop in Ireland and the deficient harvests had necessitated an increase in imports which were being paid for in gold.[1] Again in 1847 the cotton crop was poor and the grain supply deficient. Coupled with this demand for gold was the additional demand for assistance granted the Bank of France. To check this efflux of gold the bank rate was constantly raised until in October, 1847, it stood at 8 per cent. From this time on, the panic being over, gold rapidly returned.

In France, for several years preceding the crisis, exports were declining while imports were increasing; and at the same time there was a slight excess of imports of the precious metals. The trade balance phenomenon was much the same for France in 1847 as for the United States in 1837.[2]

In the United States a contrary movement from that taking place in France was to be observed. We were supplying the deficiency in the European grain crop, which caused our total exports to jump suddenly from $109,000,000 in 1846 to $156,000,000 in 1847. At the same time our imports of gold were increasing rapidly. From 1845 to 1847 while our exports of precious metals declined from $8,000,000 to $1,000,000, our imports increased from $4,000,000 to $24,000,000. For the next year, however, the situation was exactly reversed.[3]

[1] Crump, *The Key to the London Money Market*, 31.
[2] *Monthly Summary of Commerce and Finance*, February, 1903.
[3] *Ibid.*

*Excess of Exports and Imports of Merchandise and Precious Metals in England.*




——— = General Trade.

– – – – – = Gold and Silver.

† Values = Excess of Exports in Millions of Dollars.
– " = " " Imports " " " "

Chart. 3.

From Monthly Summary of Commerce and Finance of the U.S. Febr. 1903

CRISIS OF 1857

For the five years from 1849 to 1853 inclusive England had an exceptionally heavy export trade in merchandise. This was due perhaps largely to the stimulus given to trade by the gold discoveries in California and Australia. For the first time the exports reached the billion dollar mark, falling back again in 1854 and not reaching that point again until 1864. Imports, on the other hand, increased at a constant and relatively slow rate, not reaching the billion dollar mark until 1860. Exports of the precious metals were also increasing at rather a rapid rate.[1]

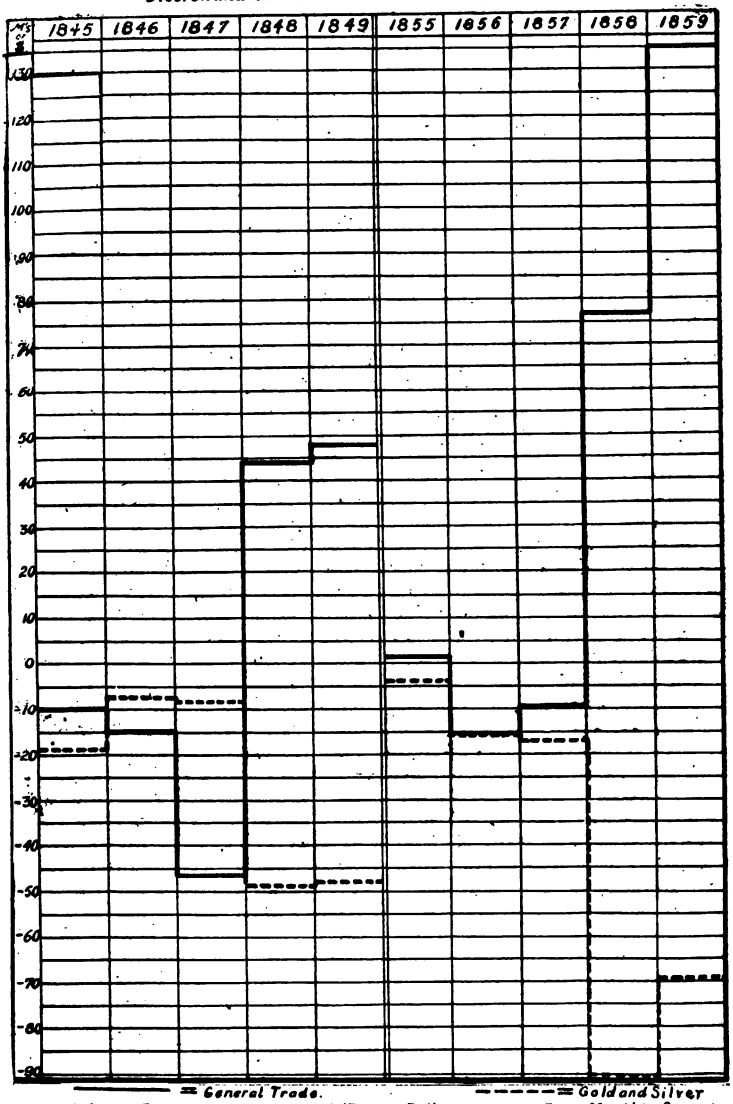
In France the trade balance changed from an excess of exports of $28,000,000 in 1854 to an excess of imports of $15,000,000 in 1856 and of $9,000,000 in 1857. For several years preceding and following these two years there was an average of an annual excess of exports of half a million. There was also an excess of imports of the precious metals, increasing from $4,000,000 in 1855 to $91,000,000 in 1858.[2] It might also be added that for the same period, from 1849 to 1853, as in England, France had an extra large excess of exports, showing that her trade was also receiving a stimulus, and probably also from the gold discoveries in California and Australia.

In the United States from 1850 to 1857 there was an unusual excess of imports.[3] This could be attributed to two causes, the increased trade activity in the West due to the discovery of gold, and the rapid internal development of the country. Too much emphasis, however, must not be laid upon these relatively slight excesses on either side as indicative of the operation of some particular force, for they may simply be the result of a general expansion of trade which would naturally exaggerate the usual differences between total exports and total imports of a country.

There was also a considerable securities movement, as in the period preceding the crisis of 1836–39. Foreigners were again investing heavily in American securities. It is estimated that

[1] *Monthly Summary of Commerce and Finance,* February, 1903.
[2] *Ibid.*
[3] *Ibid.*

*Excess of Exports and Imports of Merchandise and Precious Metals in France.*



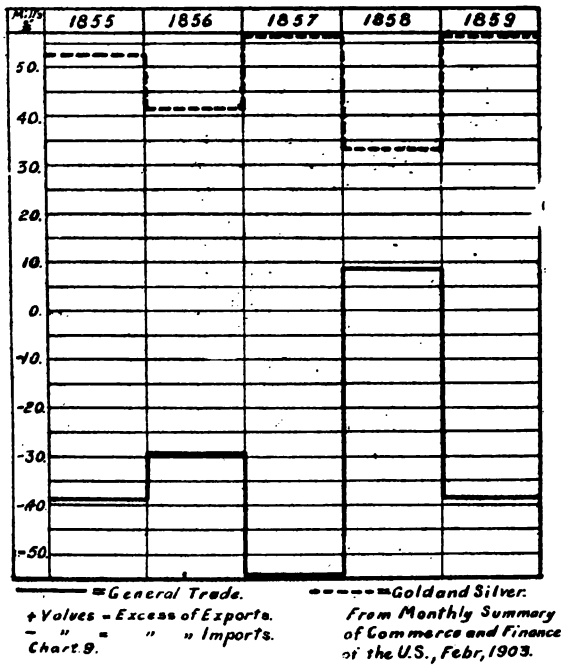

† Values = Excess of Exports in Millions of Dollars.
– " = " " Imports " " " "

From Monthly Summary of Commerce and Finance of the U.S., Febr, 1903.

Chart 7.

England alone had $400,000,000 of capital invested in the United States at this time.[1]

*Excess of Exports and Imports of Merchandise and Precious Metals in the United States.*




## IV

### CRISIS OF 1836–39

We now come to a consideration of the strictly financial operations. Under this category we treat of the psychic factors, such as loans, foreign exchanges, clearances, bank rates, etc. These psychical elements, although they must necessarily affect and control more or less the material elements, are nevertheless distinct from them.

[1] Sumner, *History of American Currency*, 170.

In England in 1834–35, loans to Spain and Portugal started an outward movement of gold which, however, as pointed out before, was reversed as a result of the slight panic in 1835. The only other financial operations on a large scale previous to the crisis were those in the United States.

During the crisis, however, England resorted to some large credit operations in order to tide over temporary monetary difficulties. Hard pressed on account of the drain of gold to the United States, Belgium, and other countries, she attempted to dispose of a considerable quantity of public securities. In the latter part of 1838 she succeeded in selling £760,000 of these securities and at the same time drew upon Paris for £600,000 in bills of exchange. Again, from July, 1839, to April, 1840, Baring Brothers entered upon negotiations with several Parisian bankers to draw bills of exchange to the extent of £2,000,000. By the same operation £900,000 more were procured at Hamburg.[1] Immediately following these credit operations the crisis passed over and gold began to return.

The question now naturally arises as to whether or not it was necessary for England to allow all her gold to escape until she was forced to ask for assistance abroad. An explanation may be found, perhaps, in a study of bank rates. In both years 1836 and 1839, when gold was being exported, she did not raise the rate of discount until the reserves had suffered severe losses, and then only gradually, and not sufficiently to operate quickly. Now the balance of trade was favorable to England, and the only cause for exports of gold, unless securities more than offset the excess of exports, must have been the difference in rates of interest. Hence the only logical course for England to pursue was to raise her bank rate sufficiently to offset this difference. This she did not do, and many authorities, especially Juglar, criticise this course of action severely. Nevertheless, it might be well to consider here the plight of the United States had England been able to retain her gold. Still, from the national rather than the international point of view, it would no doubt have been policy for England to have raised her rate sooner than she did.

[1] Juglar, *Les Crises Commerciales*, 348.

As an indication of the speculative character of the times, a glance at the securities market may be of interest. The Spanish loans of 1834–35, according to Crump,[1] "engendered such a spirit of speculation in kindred securities which had been neglected that in some cases there was a rise of 100 per cent." This advance in securities received a temporary check by the panic of 1835. Immediately after this slight panic prices revived and there was increased speculation, especially in American securities, which continued until the breaking out of the crisis. Finally, in June, 1839, upon the announcement of the directors of the Bank that the bank rate was to be 5½ per cent and advances were to be made upon bills of exchange only, there was a general fall in the prices of securities.[2]

The United States, on account of increased confidence abroad, due largely to the reduction of our public debt, had been enabled to do an extensive credit business with Europe. Furthermore, the extension of credit and the creation of credit institutions were going on at home at a very rapid rate. State bonds were sold to form banks and construct canals. Vast tracts of western land were purchased on time, and part payments were made with an inflated paper currency.

In addition to this over-extension of credit, the situation was rendered worse by certain financial measures taken by the administration. July 11, 1836, was issued the specie circular, requiring specie payment for land sales in the future. Furthermore, about the same time occurred the distribution of the surplus revenue. In accordance with this measure about $37,000,000 were to be distributed among the states according to population. About $28,000,000 were actually turned over, half of which amount was transferred during the early part of the year 1837.[3] This resulted in disturbance due to the transfer of capital rendered necessary because of the fact that a large part of the deposits were in the less populous states.

[1] Crump, *The Key to the London Money Market*, 29.
[2] *Ibid.*, 30.
[3] Dewey, *Financial History of the United States*, 220.

The different states devoted their quota of this distribution to various uses. In some states there was a per capita distribution; in others the whole fund was invested in internal improvements, and so on. In practically all cases, however, it gave an additional impulse to the speculative movement.

As in England, and perhaps to an even greater extent, the prices of stocks were booming. Not only were there plenty of home investors, but foreigners also were investing in railways and in state and municipal bonds.[1] Foreign capital was being used to develop American resources.

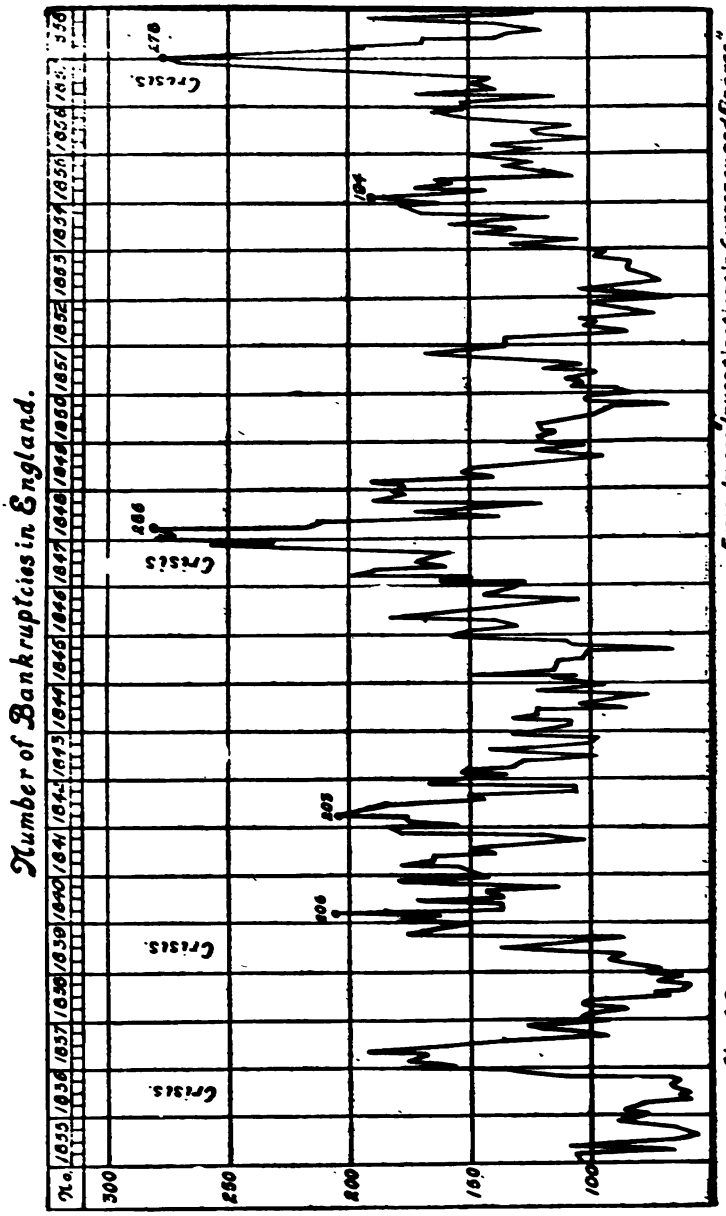
## CRISIS OF 1847

In England there seem to have been no important financial operations, preliminary to the crisis, except that of launching great railway enterprises. Still it is estimated that something like £70,000,000 to £100,000,000 was asked for in contribution to foreign projects after the speculative movement had begun. This amount is small, however, in comparison with the £600,000,000 which it is estimated would have been required to complete all the lines projected in Great Britain.[2] The speculation was confined chiefly to English railways.

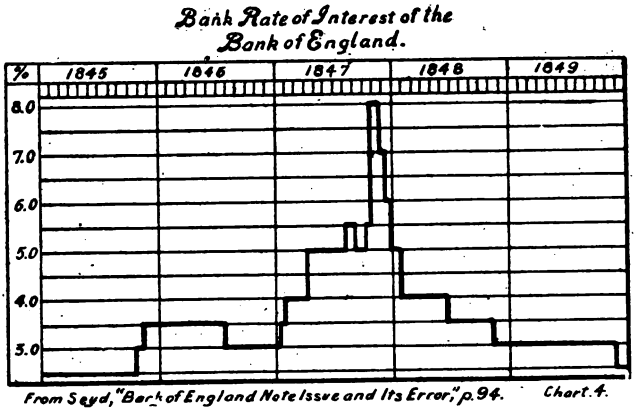
In addition to this demand for money for railways other demands arose during 1846 and 1847. Owing to the fact that France had an inadequate supply of silver to meet current needs, Baring Brothers agreed to assist the Bank of France to the extent of £1,000,000, early in 1846. Again, in March, 1847, owing to the suffering in Ireland due to the potato famine, Rothschild and Baring Brothers negotiated a loan of £8,000,000.[3] Some relief came to France and indirectly to England when Russia purchased 50,000,000 fr. 3 per cent rentes belonging to the Bank of France.

Finally, the general crop failures necessitated unprecedented importations of various kinds of food in 1847. The cotton crop

[1] Dewey, *Financial History of the United States*, 226.
[2] Evans, *The Commercial Crisis of 1847–48*, 10–11.
[3] *Ibid.*, 55–56.

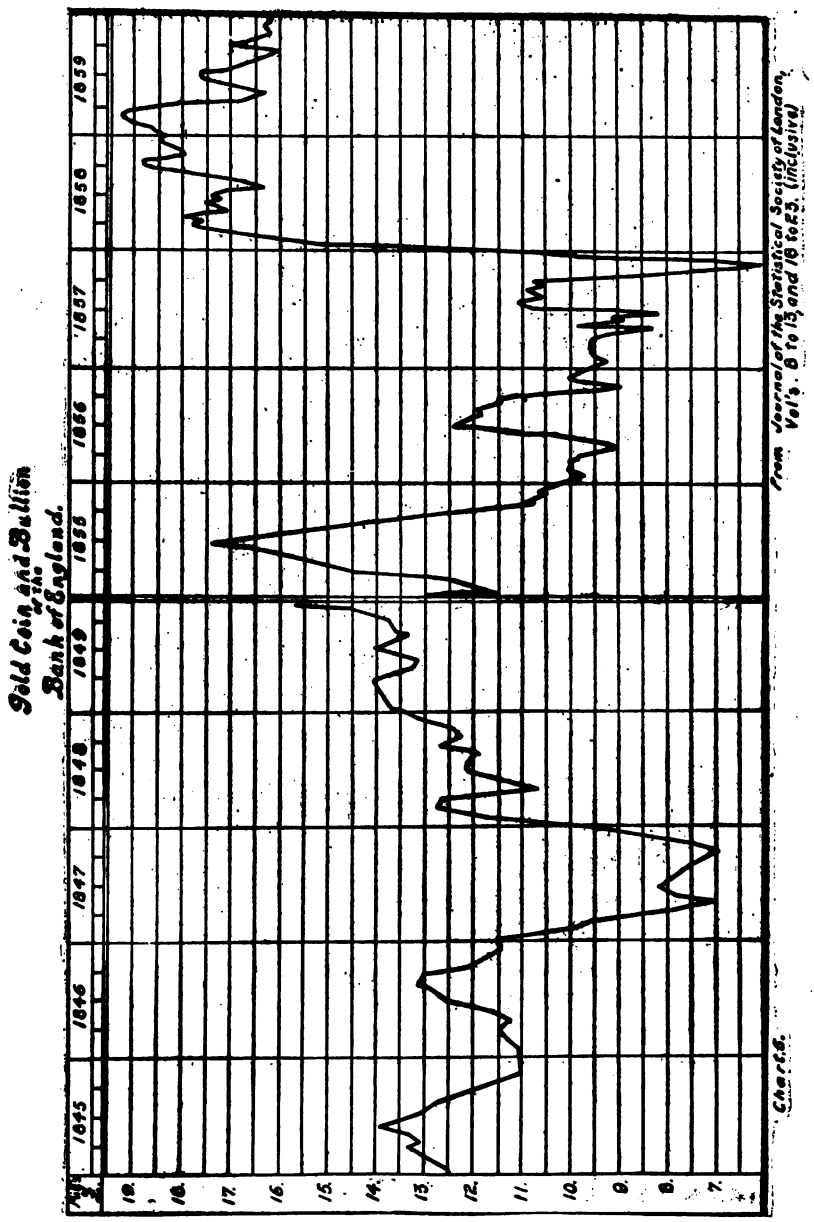

Number of Bankruptcies in England.
No.
300
250
200
150
100
Crisis.
Crisis.
Crisis.
Crisis.
Chart. B.
From Jevons' Investigations in Currency and Finance."

was also deficient. These excessive imports were paid for in gold, and again the Bank was tardy in raising the rate. This was a financial result from the trade situation, since payment for goods constitutes a little different case from shipments of gold simply for the purpose of realizing a profit from the differences in rates of interest. From May 4 to October 19, 1847, £593,933 were exported to America.[1] That raising the bank rate constitutes an effective check on gold exports is illustrated by a relanding of 100,000 sovereigns destined for America in the latter part of 1847 as a result of the sudden rise in the bank rate.[2]




The movement of securities was similar to that in any speculative period. From January to May, 1845, there was a rapid advance. Great Western and London & N. Western stocks rose from 178 and 236 to 200 and 253½ respectively. From May to July there was a slight advance. From August to October about as marked a decline as there was advance in the early part of the year. From November to December there was a slight rise of not more than three or four points. From January to March, 1846, Great Western fell from 170 to 150 and London & N. Western fell from 230 to 224. April to December, 1846, a fall

[1] Evans, *The Commercial Crisis of 1847–48*, 65.
[2] Juglar, *Les Crises Commerciales*, 362.


Gold Coin, and Bullion in the Bank of England.
From Journal of the Statistical Society of London, Vol's. 8 to 13, and 18 to 23, (inclusive)
Chart 8.
1845
1846
1847
1848
1849
1855
1856
1857
1858
1859
18.
17.
16.
15.
14.
13.
12.
11.
10.
9.
8.
7.

averaging about ten points. In 1847, from January to September, Great Western fell from 139 to 110 and London & N. Western from 202 to 167. In October they dropped to 102 and 161 respectively, near which points they remained for the rest of the year. In all, from May, 1845, to the end of 1847, the fall in the two securities amounted to over 50 per cent.[1]

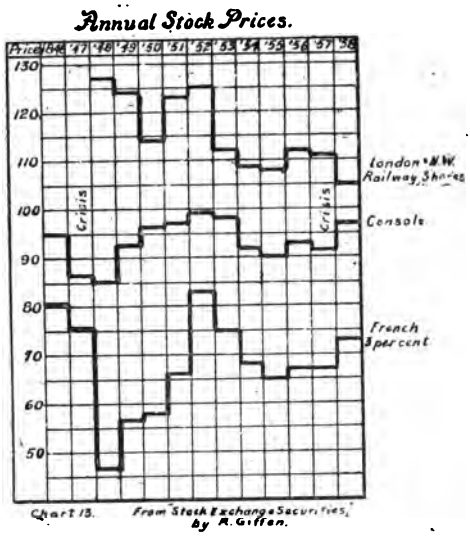
So far we have confined our attention to railway securities. Turning to government securities, consols; we find an almost identical movement. An exception is to be found, however, when from January to May, 1845, railway securities experienced an excessive rise, government securities declined slightly. But during all of 1846 and 1847 both declined, although private securities declined the more rapidly.[2] The phenomenon observed in the early part of 1845 may perhaps be explained by the suddenness of the boom in railways, which promised enormous profits, and this would turn aside capital temporarily from investment in public securities. This alternation of demand between public funds and speculative securities has been often noticed.

In France the situation was practically the same as in England, with the exception that the government was taking a more leading part in the speculative movement. Within a year or two the government had borrowed from the Bank of France £2,000,000 sterling for the construction and improvement of public works. When this was added to the enormous sums expended for railway construction and for grain obtained from the Baltic and Black seas, it constituted a severe strain upon the Bank. Finally recourse was had to a loan, and the bank rate was raised. Eight hundred thousand pounds was obtained from Baring Brothers of London, and the rate of discount was raised from 4 to 5 per cent.[3]

For reasons already presented, the European crisis of 1847 affected the United States only slightly and even then not until one year later. That the effect of a foreign crisis can not be entirely avoided is shown by this fact, that in spite of our excessive exportation of grain, giving us a favorable trade balance,

[1] See chart on the next page.
[2] Evans, *The Commercial Crisis of 1847–48.*
[3] *International Cyclopaedia,* vol. VI.

our store of bullion fell from $49,000,000 to $35,000,000.[1] The effect of the French revolution of 1848, however, must also be given some weight as a condition affecting commerce in general, especially for that year.

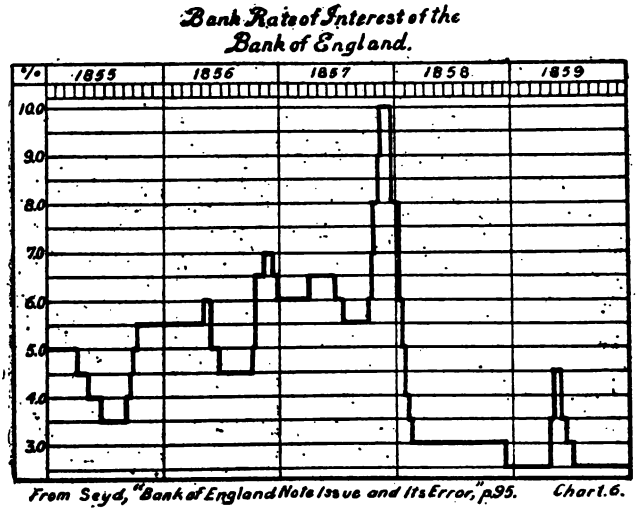



## CRISIS OF 1857

The panic of 1857 is characterized by Evans as a banking panic which broke out first in the United States and from there spread to Europe. This, however, does not necessarily place the entire responsibility for the crisis upon America. There is no question but that England and other European countries were doing business upon an unsound basis. Particularly to blame was the system of "open credits" practiced in England. By this plan "certain English houses allowed persons abroad to draw upon them to an extent previously agreed upon." As an illustration of how this led to abuse of credit, a particular firm suspended which had been doing business upon a capital of £10,000, with a liability of £900,000; it had permitted "itself to be drawn upon

[1] Dewey, *Financial History of the United States*, 260.

by foreign houses, without any remittance previously or contemporaneously made, but with an engagement that it should be made before the acceptance arrived at maturity."[1]



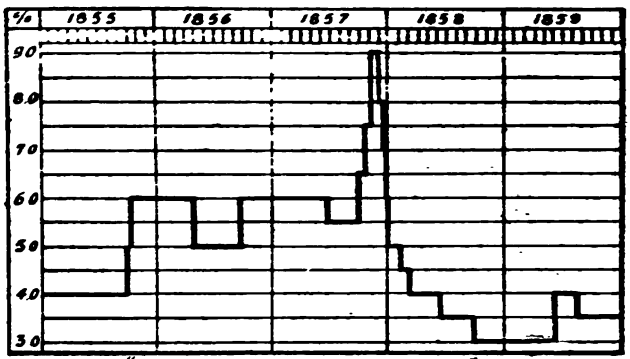

The permanent cause at the bottom of this extension of credit was a force already alluded to in the discussion of changes in the permanent environment, namely, the enormously increased output of gold. Statistics show that for England there had been excessive imports of the precious metals. This was accompanied or perhaps followed by a correspondingly increased foreign trade. These factors demanded increased facilities for distribution of capital. The usual results followed. A movement of speculation was started within the financial circle itself.

In France the period 1840 to 1857 is characterized as an era of invention and improvement. To further the onward movement, checked by the panic of 1847 and the revolution of 1848, the government came to the aid of the railway and telegraph companies. To accomplish this some large financial operations were necessary. Large loans were obtained from the Bank of

[1] Evans, *The Commercial Crisis of 1857–58*, 33–34.

France and from private capitalists. This undoubtedly accounts for a great part of the enormous deficiency in the French budget during this period.

*Bank Rate of Interest of the Bank of France.*



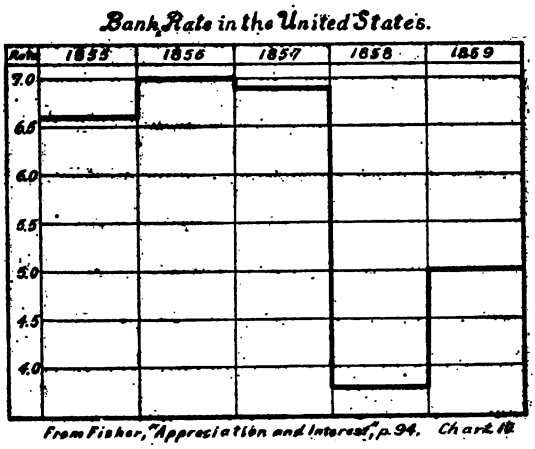

*From Seyd, "Bank of England Note Issue and Its Error", p. 95. Chart 8.*

Agricultural interests were also booming. But here, too, there was a dearth of capital. Complaints were made that farmers were not able to make improvements at a rate in keeping with the general advance of the times. Finally credit was resorted to. In 1848 was created the Comptoir d'Escompte de Paris, a large credit institution. In 1852 the great Crédit Mobilier was founded. These credit institutions made loans to farmers on land security. At first these institutions promised to become a permanent feature, but just previous to 1857 they also became infected with the speculative mania.

In the United States, where the crisis is said to have originated, we may expect to observe marked evidences of an approaching storm for some time before the actual outbreak of the crisis. But such seems not to be the case. Indeed, our foreign trade was climbing up to an unprecedented height; but that was not the occasion of much alarm, for our purchasing power also was making rapid gains. Since the discoveries of gold in the West, that article had become almost an ordinary article of merchandise, so that there was nothing alarming in the increased exports of

gold. Our population was making rapid strides, and in addition the United States within a few years had greatly enlarged their share of ocean shipping.[1] These things partly, if not fully, offset an apparently unfavorable trade balance.

Now what were the financial forces, if any, set in motion to accelerate or retard the crisis? According to Gibbons, the whole cause of the crisis was the near-sighted policy pursued by the banks in suddenly contracting their loans upon the first suspicion of approaching financial distress. The crisis once under headway, he attributes its further course to the depositors who withdrew their deposits as suddenly and with almost as disastrous results as accompanied the contraction of loans. "In twenty-one days, the deposits fell 25 per cent, while the loans were reduced but 11 per cent—a complete transposition of the movement following the 22d of August when they fell but 11, while the loans decreased 29 per cent."[2]




But this explanation of the crisis is superficial. At least it appears much sounder to say that the causes were deeper seated than this; that in fact the cause or causes were closely connected with the general methods of doing business at this time. Per-

[1] Dunbar, *Economic Essays*, 268.
[2] Gibbons, *Banks of New York and the Panic of 1857*, 370.

haps the bankers might have mitigated the effects of the crisis by refraining from a policy of contraction, but that is about all that can be said for Gibbons' theory.

What was the real cause which prompted the bankers in the interests of self-protection to contract their loans? If there was a sole cause it was the excessive construction of railways. As pointed out before, the number of miles constructed was beyond the needs of the times. An action of the government greatly aggravated this evil. From 1850 to 1856 the government granted 20,000,000 acres of land as subsidies to aid the construction of railways in the West and South.[1] The result was that railways were constructed where they were not needed, for the purpose of getting the subsidies. All the circulating capital was absorbed where there already existed but an insufficient supply, and an excessive abuse of the credit system sprang up, particularly in the West and South.

To supply the increased demand for capital for railway construction, new banks were created and old banks increased their loans. According to Gibbons, in New York alone there were twelve banks formed in 1851, six in 1852, and nine in 1853.[2] Extension of railways called for more banks, and more banks permitted further railway extension. Thus an endless chain was formed. And so it was with other enterprises, private and public.

## V

In conclusion, a thorough and comprehensive treatment of the subject of crises has not been attempted. We have simply outlined very briefly what seems to be a logical method of studying them with the view of ascertaining the causes. To apply this method we have taken three crisis periods and have gathered from them such facts as are accessible to the ordinary reader and fitted them into the framework of our method. How far these facts have been assimilated into the method without violation of accepted economic law the reader may judge.

[1] Dunbar, *Economic Essays*, 272.
[2] Gibbons, *Banks of New York and the Panic of 1857*, 370.

We have pointed out the probable causes. Generally, if not always, the *origin* of the crisis can be traced to some excessive change or changes in the permanent environment. The excess itself, that is, the surplusage beyond the needs of the times, is the real *cause* of the crisis. Change in the permanent environment alone involves no danger whatever so long as that change is really permanent, i. e., not in excess. But as we can conceive that if all the capital of a country were suddenly diverted to railway construction, sudden bankruptcy and paralysis of business would inevitably result, so also can we conceive that excesses in a much less degree may involve a country in serious financial trouble. Certainly is that possible when the surplusage, though seemingly slight, is found not only in one but in several enterprises.

In 1837 England constructed too many railways and formed too many joint-stock banks; France formed too many literary companies; and the United States constructed too many railways, formed too many banks, and extended the crop areas too rapidly. The situation in the United States was rendered worse by Biddle's speculation in cotton, which was a short-time influence also. In 1847 England's speculation was confined to railways with the result that railway building was disastrously overdone. Coupled to this were general crop failures and a potato famine in Ireland. In the United States there was almost an entire lack of speculation. Close proximity to a depression following the crisis of 1836–39 and a costly war, robbed us of crisis material, i. e., capital. In 1857 the crisis in Europe was characterized by speculation and over-investment in general. In the United States the speculative spirit was concentrated upon railways.

Now the origin of this impetus to build railways, to form banks, to extend crop areas, etc., is frequently difficult to locate. It may arise from a discovery or invention, from a labor dispute; from some financial policy pursued by the banks, from governmental subsidies, from increase of population, etc. But we can locate it in its effect upon the permanent environment, and that affords us a working basis. There we have the force in tangible form and can observe its workings prior to the actual occurrence of the panic, and that is, after all, the most that we care for.

So far in our study we have observed that whatever be the original impulse, capitalists do go to extremes, and furthermore that no way has yet been discovered of measuring how far a certain environmental change should be allowed to go, or, if that could be determined, how to check it. Experience seems to prove that we advance by leaps followed by rests. We allow our railway mileage to fall below the actual needs of the times and then advance it far beyond. We seem to experiment upon the amount of change needed,—overestimate it perhaps, when a readjustment follows in which the excess is rejected. Then we resume a normal state to begin another series of experiments ending in a new readjustment.

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UNIVERSITY STUDIES

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# I.—*On the Movements of Petals*

BY ESTHER PEARL HENSEL

## INTRODUCTION

The following paper has to do with an investigation of the physical causes which bring about opening and closing movements, periodic or otherwise, of certain flowers. With that end in view, seven different species of flowering plants have been experimented upon directly, a much larger number being simply observed with respect to the nature, time, etc., of their anthotropic movements.

Movement consists in the corolla taking upon itself either the open or closed position for certain periods of the day or night; for example, the morning glory (*Ipomoea purpurea*) opens early in the morning (from 4:00 to 5:00 A.M., in the greenhouse) and closes from 11:00 A.M. to 2:00 P.M., or even 5:00 P.M. on cool days, while the common dandelion (*Taraxacum taraxacum*) opens from 7:00 to 8:00 A.M. and closes from 5:00 to 6:00 P.M.

In the closed position, the petals or florets may assume practically the same position as that of the bud, as in the gentians, asters, dandelions, etc.; often, however, the edges of the petals only touch, forming a dome inside of which the stamens and pistil are well protected, as in the wild rose and in the tulip. In

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some genera, as in Mentzelia, the sepals may stay reflexed after the first opening.

For convenience, flowers which are influenced in their opening and closing by the amount of heat present may be grouped into four classes as follows:

I. Day-bloomers.
   1. Those that open only during the day, but for two or more (sometimes several) days in succession (hemeranthous).
   2. Those that open only during one day or part of a day, then the corolla withering, deliquescing, or dropping at once (ephemeral-hemeranthous).

II. Night-bloomers.
   3. Those that open only during the night, but for successive nights (nyctanthous).
   4. Those that open for only one night or part of one night (ephemeral-nyctanthous).

All flowers not included in these types open at any time of the day or night and stay in this condition through day and night until the end of their existence, irrespective of the amount of heat present. Whether a flower is a day-bloomer or a night-bloomer seems to depend upon nothing so much as habit, the conditions surrounding the plant, its environment, in no way influencing this aspect. The purpose of this paper is to explain the causes of opening and closing in any type by means of experiments.

The form of the corolla and its physical condition when mature, i. e., dry shriveling, deliquescing, deciduous when yet fresh, etc., do not seem to influence the kind of movement; any type, for instance day-bloomers, may have the extreme variety of forms of corolla, from undivided, as in the morning glory, to divided, as in the tulip; the corolla itself may vary in its physical characteristics, e. g., in ephemeral day-bloomers from dry shriveling in the spring lily (*Erythronium albidum*) to deliquescing in the spiderwort (*Tradescantia bracteata*) and deciduous

in flax (*Linum usitatissimum*). The corolla may also change in color upon withering, as in the evening primrose (*Pachylophus caespitosus*), the waxy white petals turning a dull pink upon withering.

The life of an individual flower varies from a few hours, as in the ephemeral species, to many days. According to Kerner and Oliver, the range is from 3 hours (in *Hibiscus trionum*) to 80 days (in *Odontoglossum rossii*). Whether the length of life of an individual flower and the closing at certain hours have anything to do with the pollination of the flowers by certain insects is not a question to be discussed here, however interesting it may be. The two are closely connected but are not cause and effect.

Following is a list of plants which show these movements, those preceded by a * having been experimented upon directly; the others were simply observed. The list is very small when compared with the cases actually known, since it simply includes those coming under personal observation within the last two or three years:

| I. Day bloomers. | DAYS | OPEN A.M. | CLOSED P.M. |
|---|---|---|---|
| 1. Opening and closing repeatedly. | | | |
| *Agoseris greenei*, (Gray) Rydb. | 1–2 | 7:00– 8:45 | 2:00–3:00 |
| *Claytonia virginica* L. | 2 | 8:00– 9:00 | 6:30–7:30 |
| *Crocus vernus* All. | 12 | 9:00–10:00 | 4:00–5:00 |
| *Erigeron flagellaris* Gray | 2 | 9:30–10:30 | 5:00–7:30 |
| *Gentiana acuta* Michx. | 4 | 8:00–10:00 | 5:00–6:00 |
| *Gentiana frigida* Haenke | 4 | 8:00–10:00 | 5:00–6:00 |
| *Gentiana parryi* Engelm. | 4 | 8:00–10:00 | 5:00–6:00 |
| *Lactuca scariola* L. | 2+ | 8:00– 9:00 | 3:00–4:00 |
| *Machaeranthera aspera* Greene | 4+ | 7:00–10:00 | 4:00–6:00 |
| *Rosa woodsii* Lindl. | 4 | 6:00–10:00 | 7:00 |
| **Taraxacum taraxacum* | 2 5 | 6:00– 8:00 | 5:00–7:00 |
| *Tulipa gesneriana* L. | 5–7 | 9:00–10:00 | 5:00–6:00 |
| 2. Opening and closing but once, 1 day or less. | | | |
| *Epilobium adenocaulon* Haussk. | | 9:00 | 3:00–5:00 |
| *Erythronium albidum* Nutt. | | 8:00– 9:00 | 6:00–7:00 |
| *Specularia perfoliata* (L.) A.DC. | | 7:00– 8:00 | 3:00–7:00 |
| **Linum usitatissimum* L. | | 5:00– 8:00 | 10 A.M.–2 |
| **Oxalis stricta* L. | | 8:00– 9:00 | 3:00–4:00 |
| *Portulaca oleracea* L. | | 10:00–11:00 | 3:00–4:00 |

| | OPEN A.M. | CLOSED P.M. |
|---|---|---|
| *Sisyrinchium angustifolium* Miller | 9:30–11:00 | 5:00–6:45 |
| *Tradescantia bracteata* L. | 5:00– 6:00 | 4:00–5:00 |

| II. Night bloomers. | OPEN P.M. | CLOSED A.M. |
|---|---|---|
| 3. Opening and closing repeatedly. | | |
| **Mentzelia nuda* (Pursh.) T. & G. 4–5 days | 3:00–5:00 | 5:00– 6:00 |
| 4. Opening and closing but once. 1 day or less. | | |
| *Allionia linearis* Pursh. | 5:00–6:00 | 8:00– 9 00 |
| *Allionia nyctaginea* Michx. | 4:00–5:00 | 9:00–10:00 |
| *Cereus grandiflorus* Mill. | 8:00–9:00 | 2:00– 3:00 |
| *Datura stramonium* L. | 5:00 6:00 | 8:00–11.00 |
| **Ipomoea purpurea* (L.) Roth. | 4–5 A.M. | 10:30 a.m.–3 p.m. |
| **Mirabilis jalapa* L. | 6:00–9:00 | 10 A.M.–4 P.M. |
| *Onagra biennis* (L.) Scop. | 5:00–6:00 | 9:00–10:00 |
| **Pachylophus caespitosus* (Nutt.) Raimann | 5:00–8:00 | 9:00–11:00 |
| *Silene hallii* Wats. | 5:00–7:30 | 9.00–12.00 |

All flowers not included in the previously stated types stay open through the day and night during their period of existence. Such flowers do not open because of temperature changes but because they have reached a certain period of growth; the largest number of flowers belong here. Of the other classes, a very large number are day bloomers, a smaller number night bloomers.

Ephemeral flowers behave much as those flowers which open and close for several days, that is, they are influenced by temperature variations; in their opening, however, they show a close relation to the large number of flowers which open only once and stay open until they die (generally after several days); the chief difference is that the ephemeral species are more regular in the time at which this process occurs.

## HISTORICAL REVIEW (FROM 1686 TO 1905)

So much has been written on the subject of flower movement, and with such different views as to its cause, that it seems advisable to give a rather detailed account of the work of the different investigators.

Pfeffer reports Cornutus as having said as early as 1686 that heat caused, or at least hastened, the opening of the anemone.

Whether this was a theory or had really been found out from experimentation, I am not able to ascertain, as I do not have access to the original paper.

Linné in 1751 gave many instances of flower movement. He made a list of forty-six species with the time of opening and closing of each. These he called "sun flowers" ("solares flores") and divided them into (*a*) those which the conditions of shade, humidity of the air, and atmospheric pressure affect directly ("meteorici"); these do not open during cloudy or rainy weather; (*b*) those that open in the morning but close before evening, at different times according to the light ("tropici"); (*c*) those that open and close at a certain hour of the day ("aequinoctiales"). These last he grouped into his "Floral Clock" according to the hours of the day at which they open and close their flowers, every hour being represented by two or three opening or closing flowers; composites were also included here since the ray florets act much as the petals of simple flowers. It is quite significant of the importance of the subject that it should have been known even thus well over two hundred years ago.

According to Royer, Duhamel (a contemporary of Linné's) attributed opening to heat and turgescence, but said that heat rarified the cell sap, quite contrary to the later view that turgescence is due to an excessive flow of liquids to certain regions.

Dutrochet in 1836 gave as the cause of the opening and closing of four-o-clocks (*Mirabilis jalapa* and *Mirabilis longiflora*), the morning glory (*Ipomoea purpurea*), and the dandelion (*Taraxacum taraxacum*) turgescence and the filling of the fibrous tissue with oxygen. He attempted to explain the process in this way: on the external side of the corolla nerves, parenchymatous tissue is arranged in longitudinal rows, while on the internal side there is fibrous tissue, the two tissues tending to curve in opposite directions and thus draw along the other tissues surrounding them. Opening and closing result from the alternately predominant action of one or the other tissue. The parenchymatous tissue tends to curve outward by filling with water, thus causing opening in flowers of Mirabilis; the fibrous tissue curves outward by the chemical action of the oxygen in the water, causing closing

of the flower. The reason that Mirabilis closes earlier than Convolvulus is because it is easier for Mirabilis to fill its fibrous tissue with oxygen under the influence of light and heat. In the case of flowers opened and closed for several days, as the dandelion, etc., the fibrous tissue becomes gradually filled with oxygen during the day when the flower is open. At the same time, the sap current is diminished because of the decreasing light, thus decreasing turgescence; in consequence, the cellular tissue curves inward and the flower closes.

Hermann Hoffmann (1850) brought together results showing that temperature was the all-important factor in opening and closing, light influencing the processes only as it contained heat rays. His experiments were conducted upon foliage leaves of *Oxalis tetraphylla* and *Mimosa pudica,* and the flowers of *Tolpis barbata, Oenothera lindleyana, Onagra biennis, Lotus peregrinus, Ipomoea purpurea,* and *Eschscholtzia.* These were the principal species experimented upon; several others, however, were used to help disprove that sleep movements are caused by moisture in the air, electricity, or the expansion of gas within the plant—causes to which opening had been ascribed. He further proved that opening can be caused artificially at the hour of most profound sleep by simple increase of heat without the aid of light, but that the prolongation or excess of heat caused sleep. He stated also that the dilatation of the sap by the action of heat could not cause the daily expansion of a flower, since water expands only 1/22 of its volume between 0° and 100° C.

Royer (1868) affirmed that variations of heat and turgescence —complements of each other—were the cause of all flower movements. *Taraxacum taraxacum, Crocus, Tulipa gesneriana, Ficaria ranunculoides,* and *Bellis perennis* were experimented upon by him as examples of sleeping flowers, i. e., those that open and close several times. He made a close distinction, however, between sleeping flowers and ephemeral ones, such as *Convolvulus arvensis, C. sepium, Glaucium flavum, Stellaria media,* and several Veronicas, which sleep only in appearance and close only when their existence is ended. These latter, he said, could be transformed into sleeping flowers by humid earth, shade, late

flowering, etc.; and, vice versa, sleeping flowers could be made ephemeral by increased heat and dryness, or when the whole flow of sap toward the flower was hindered. In his opinion, turgescence and heat caused opening and closing by the unequal dilatation of the faces; without heat there was no dilatation, without turgescence no elasticity. The internal face, on account of its position, was less exposed to the action of the air and dilated more than the outer, causing opening. Prolonged and abundant transpiration diminished turgescence, and sleep occurred; then the internal face was shortened and the outside became plane and convex.

De Candolle, a contemporary of Royer, has been stated by the latter as having emphasized light as the factor causing opening and closing movements.

Light and moisture, and a certain law of periodicity, were stated by Balfour (1875) to be the cause of sleep movements of flowers, periodicity (or habit) being given almost first place.

Darwin (1881), as we should expect, held to the latter view, saying that movement was a quality inherited by both plants and animals. He agreed with Pfeffer that nyctitropic movements of flowers are caused by unequal growth of the two sides of the petals due to temperature changes.

Gustav Zacher (1881) ascribed floral movement of *Lotus ornithopodiodes* to light, but more especially to the variability of the amount of water in the water vessels.

Pfeffer reports Hofmeister to have said that temperature changes caused movements in garden tulips.

According to Sachs (1882 and 1887) light was the all-important factor; temperature and humidity were given a secondary place, it being only occasionally, as in Tulipa and Crocus, that they were the important factors. However, Pfeffer's experiments (1876) were mentioned by him, and he certainly considered them valuable. Pfeffer's experiments on Tulipa, Crocus, *Adonis vernatus, Ornithogalum umbellatum,* and *Cochicum autumnale* make heat the most important element. He considers opening and closing mere growth movements; heat and light, as they diminish at night, cause the outer surface to grow faster

than the inner, and the flower closes, or, in the case of flowers remaining open at night, meteoric influences affect the internal and external surfaces in the opposite way.

It is due to Anton Hansgirg, first in 1890, and then later, that we have such exhaustive lists of plants possessing what he calls "gamotropic" and "carpotropic" movements, principally the latter. Under the former term he includes movements that serve to protect the ovary and stamens and to make cross-fertilization easy; under the latter, those growth movements of flower stems by which the flower is placed in a certain position at one period of its growth, and in a different one at a later period; for example, the morning glory bud and flower are erect, while the fruit is pendulous. Movements of the calyx, involucre, etc., to protect the fruit, are also included under "carpotropic" movements. The real cause of what he terms "gamotropic" movements, those serving to protect the ovary, stamens, etc., he does not state directly, but in a later paper he remarks that carpotropic nutation movements are not so dependent upon the daily change of light as the nyctitropic and gamotropic appearances. He also makes the statement that carpotropic movements must be distinguished from those similar to nyctitropic and gamotropic ones which occur through epinasty and hyponasty—the merely passive movements without growth. In a still more recent article (1892) he adds a few facts on the subject, but offers no explanation, saying that it is yet to be proven whether periodic opening and closing are caused by changing epinastic and hyponastic growth of flowers. He states that such movements are inconstant in different genera of the same family. The same lists of species were continued in 1896 when he assigned to gamotropic and to nyctitropic movements light and heat as causes. He divides gamotropic flowers into: (*a*) those periodically opened and closed, (*b*) ephemeral, day or night, (*c*) those that open only once and stay thus until withering (agamotropic), and (*d*) those that are pseudocleistogamous and hemicleistogamous. Light is given importance, for ephemeral flowers can be made to become two-day flowers if deprived of light. In 1902 still further additions were made to these lists of species possessing types of car-

potropic and gamotropic movements. Here, as in earlier publications, he concludes by saying that the exact causes are unknown.

In a paper published in 1890, Hermann Vochting treats of the influence of temperature upon the flower movements of *Anemone stellata*—those of the flower pedicel especially—but he also mentions that the opening and closing are connected with the unequal growth of the upper and under sides of the basal portion of the floral leaves.

Friedrich Oltmanns (1895) gives to light the most important place in causing nyctitropic movements of flowers, the more intense the light, the earlier the closing or opening, a certain quantity of light being necessary for the withering of ephemeral flowers or the closing of periodically moving ones. He makes the statement that Royer, De Candolle, Dutrochet, and Meyen have all thought light an important factor, while Pfeffer considers that heat works with light in causing flowers to open in the morning.

Kerner and Oliver (1895) say that the opening of flowers is promoted by sunshine, but whether it is light or heat is to them a question. Kerner says that the amount of pollen produced and the number of flowers on a plant directly affect the length of time a flower stays open. As to the physical cause, the sun's rays affect the tension of the tissues, but just how is not known. The movement of flowers—the change in the position of the petals—is only another expression of heat energy. The author suggests that, since anthocyanin converts light into heat, if the petals or sepals are white on the inside, the under surface must be tinged red, violet, or blue in order to cause opening.

From Strasburger and Schimper (1898) it is to be inferred that light and temperature variations are the cause of opening and closing. The same two factors are said by Ludwig Jost (1898) to cause nyctitropic movements. They work together, the two sides of a petal reacting in an opposite manner due to internal causes. His experiments were made principally upon tulip and dandelion flowers. He gives three possibilities as to the growth of the two sides. The first is Pfeffer's: the growth of the concave side is hindered by the growth of the convex side,

i. e., the concave side is passive. It is affected, later, as much by temperature changes as the convex side. The second (the most probable according to the author) is that the opposite sides react in an opposite manner to temperature changes, the restraint of the concave side being recognized as an active retardation in growth. The third possibility is that the concave side is not usually influenced by temperature changes.

Reynolds Greene's view (1900) as to the nervous mechanism of a plant is especially interesting, although flower movement is not discussed by him in his *Vegetable Physiology,* in which the former discussion is given. He says that a plant has a nervous mechanism, and that stimuli are conducted from cell to cell through the connecting strands of protoplasm which pass through the cell walls, and contrasts this with the nervous system of animals. The root tip, at a short distance from the apex, the three hairs on the leaf of "Venus' Fly Trap," etc., are special sense organs or regions, which, however, are not anatomically differentiated. The protoplasm in those parts receives the stimulus due to the physiological differentiation of the protoplasm; hence plants can respond to a more delicate stimulus than animals. The lack of coordination, however, may cause the stimulus to produce a harmful effect on the plant.

J. Bretland Farmer, in an article which appeared in the *New Phytologist* for March 19, 1902, refuses to accept the theory that epinasty and hyponasty cause opening and closing of the tulip flower. He attributes movement to a localized irritable tissue (as in Dionaea) on the outer surface of the petals. This area consists of active cells capable of altering their state of turgescence, or, at any rate, their size, more readily and effectively than the cells which form the more internal tissue layers. The intercellular spaces are large in these perianth leaves, and the cells so arranged that they give a certain amount of shearing action without damaging the cells themselves. One experiment, made by Farmer, is to put a median longitudinal section in dilute $KNO_3$ solution, which causes the petals to straighten out (open). To prove that there is an irritable tissue, he puts the petal in water, when it closes, or, rather, curves in, then in alcohol to kill

it, and finally in water or salt solution, when it straightens out again. He considers that this shows that movement is due to the life and activity of the protoplasm.

Detmar, in his recent *Plant Physiology* (1903), devotes some space to nyctitropic movements of flowers, citing a few experiments with *Leontodon hastilis, Tulipa gesneriana, Crocus vernus, Adonis vernalis,* and *Taraxacum taraxacum.* Those with Leontodon heads show, as he thinks, that light variations are very important in the opening and closing, while in the experiments with all the others, temperature variations alone cause the movements. His experiment, cited for *Leontodon hastilis,* was about as follows: he cut off during the day several stalks possessing open flowers and put them in water in the dark. They closed as usual in the evening and opened again the next morning (in the dark). The following night they closed, but would not open the next morning until placed in the light. In the evening they closed again, thus proving to his satisfaction that light in no way affects opening.

The view held by Ludwig Jost in his recent *Plant Physiology* (1904) is that not all flowers act nyctitropically to temperature variations; some react to light variations. I infer from his statements that it is variations in light that cause opening and closing in composite heads, while in Crocus it is temperature. He states that darkness has the same effect on composites as coolness has on Crocus, and that light has the same effect as heat. He adds that, generally in nature, it is the receiving of light accompanied by a rise in temperature, or the taking away of light with lowering of temperature, that causes these movements.

In the Prantl-Pax *Lehrbuch der Botanik* (1904), rising temperature and light are said to cause the inner side of floral leaves (such as Tulipa, Crocus, Adonis) to grow more than the outer; hence the flower opens. Lower temperature and light cause the outer to grow more, and the flower closes. There is a caution not to confuse these movements with those of ephemeral flowers. The author seems to make two divisions of floral movement: those caused by outside forces (autonomous), and those caused by internal forces, turgor changes, brought about by stimuli acting on the protoplasm and influencing growth (paratonic).

It is to Pfeffer more than to any one else that we owe the most of our knowledge on the subject of plant movement, more in respect to leaves than to flowers, however. Temperature, according to his view, causes the flowers of Crocus and Tulipa to open and close by certain variations. A sudden rise opens them. They then turn gradually back to a lesser opening, which position is kept constantly while the temperature remains stationary. When the temperature is lowered a similar reaction occurs. The flowers of *Crocus luteus, C. vernus,* and *Tulipa gesneriana* react in a few minutes, he says, to a rise of ½° C. The flowers of *Adonis vernalis, Ornithogalum umbellatum,* and *Colchicum autumnale* react less strongly, while those of *Ranunculus ficaria, Anemone nemorosa,* and *Malope trifida* respond to changes of 5°–10° C. Flowers of *Oxalis rosea, Nymphaea alba,* and *Leontodon* show only a common thermonastic movement with this change (5°–10° C.).

In volume I of his *Plant Physiology,* Pfeffer states that osmotic pressure varies with temperature according to the same laws that influence gaseous pressure, and hence, by a rise in temperature of 15° C. the pressure is only raised from 100 to 105.5. Thus temperature can never exercise any marked direct effect upon turgor in plants.

The most recent publication on this subject is by Walther Wiederscheim (1904). Movements of petals are said by him to be caused by variations in temperature. The flowers experimented with were Tulipa and Crocus. Burgerstein and Farmer say that the movement in these flowers is a variation movement that occurs, not on account of growth, but by the changing, lengthening, and shortening of certain tissue complexes. Jost, Schwendener, the author, and Pfeffer consider them to be growth movements, the latter saying that growth produces movement by a change in the force of expansion occurring "simultaneously and equivalently" in the two halves, but unequally fast. The other three agree in saying that growth, one phase of it, either opening or closing, occurs as a result of light or temperature stimulus but unequally, the second movement, the counter-reaction, occurring from interior causes, due to the stimulating action set up by increase in growth of the first side.

The foregoing summary of the work done on this problem since 1686 shows how very varied have been the theories as to the cause of the movement of floral leaves, and the great need for further investigation. Many of the articles which support good theories show evidence of a small or inexact amount of experimentation. This, I have tried to avoid by endeavoring to prove all statements by actual experiment, so that the final result should be conclusive. As to the exact processes which are carried on within the flower, or plant, to bring about movement, there is yet much to be done.

## EXPERIMENTAL METHODS.

Information as to the cause of floral movements was sought in two ways: first by means of field observations, and second by means of experiments performed either in the field or greenhouse, mostly the latter because of the greater ease with which the surrounding conditions could be controlled. The aim was to eliminate the possible physical factors, such as light, humidity, etc., one after the other. For example, in order to prove that humidity could not cause the opening of the flowers of the morning glory, light, heat, and the water-content of the soil were made the same in three instances: in one of these the air was made very dry, in another very moist, and in the third it was kept normal. The procedure was the same for the elimination of the other factors. The apparatus used for these experiments was very simple. For example, in the humidity experiment cited above, two large bell jars, thermometers, a psychrometer, calcium chloride for absorbing moisture, and a piece of sheet rubber to tie around one flower pot were used. Water-content and light require tin cans for soil samples, thermometers, photometers, and a shade tent. To ascertain whether heat influences opening and closing of flowers, several simple pieces of apparatus were necessary. A tin box, 2 x 2 x 2 ft., collapsible like the small tin dinner-boxes, was constructed to be used in field work, but was also found useful in indoor experiments. The top and one side were made of glass; a hole ¾ of an inch in diameter was cut in

another side to admit a cork for holding the thermometer in place. Two alcohol lamps were also found necessary, one to heat the box in which the plants were placed, the other to heat water in a retort, and thus pass water vapor into the box and produce a moist atmosphere. Self-registering thermometers and psychrometers were of great aid in taking readings of control conditions. Besides taking advantage of low temperatures in the open, or in cold rooms, double-walled bell jars packed with snow or ice were used to obtain low temperatures.

In all the experiments, strong, healthy plants were used, and no experiments were performed with flowers cut off from the plant. Wiederscheim, in his researches of 1904 on the crocus and tulip, and also Pfeffer and Jost, have affirmed that they have obtained the same results with flowers cut off from the plant as with those on the plant. Wiederscheim has even performed experiments successfully with all but one perianth leaf removed. However, unless this fact is thoroughly proved as in the instance just mentioned, it is much safer to work with the plant intact.

Unless otherwise stated, all observations apply to flowers in the greenhouse.

## EXPERIMENTS

The plants directly experimented with were the common dandelion (*Taraxacum taraxacum*), the cultivated four o'clock (*Mirabilis jalapa*), the cultivated morning glory (*Ipomoea purpurea*), the evening star (*Mentzelia nuda*), the large evening primrose (*Pachylophus caespitosus*), and the common flax (*Linum usitatissimum*). Four of these are ephemeral types, one hemeranthous (the dandelion), and one nyctanthous (the evening star).

Hemeranthous and nyctanthous flowers open and close because of temperature variations, and temperature variations alone. They undergo a resting period, they sleep, while ephemeral flowers in closing end their existence, and therefore temperature variations only prolong or hasten this process with them. Hemeranthous and nyctanthous types can be made ephemeral, or at least shorter lived, by the addition of more heat than

is normal. This is shown by the difference in the actual life of a flower blooming in the spring or in midsummer: the common dandelion lasts three to five days in the spring, while in midsummer two days is normal, on account of the more intense life of the flower at that time. On the other hand, ephemeral flowers can be made longer lived by the opposite process, the life processes going on less intensely than normal, as numerous experiments with the morning glory have shown.

The dandelion, four o'clock, morning glory, and flax were experimented with in the greenhouse, the plants being grown from seed, and the evening star and evening primrose in the open, since it was impossible to grow them in the greenhouse either from seeds or by transplanting the young seedlings. The difficulty probably lay in the fact that the change of climate, altitude, etc., was too great, from 9,000 ft. above the sea at Halfway, Colorado, to 1,200 ft. at Lincoln. At any rate, it was impossible to grow them at all from seeds, even when these were seasoned. The young seedlings of Mentzelia, transplanted in the fall from the mountains in Colorado to the university greenhouse at Lincoln, grew for a short time, but soon died, while those of the evening primrose grew fairly well during the whole year but showed no tendency to flower.

The experiments which follow seem to me to prove quite conclusively that variations in the amount of heat present are the causes of opening and closing movements among hemeranthous and nyctanthous types which are not ephemeral, and also secondarily in the latter. It is the sudden variations within a few hours which cause flower movement. Seasonal variation in temperature effects opening and closing scarcely at all, even in types of flowers (ainthous) which bloom throughout an entire season or more as the dandelion. In May it opens between 7:00 and 8:00 o'clock in the morning, in July between 5:00 and 7:00, in August between 7:00 and 8:00, and in September between 7:00 and 9:00. The plant accommodates itself gradually to these changes, and opening and closing occur regularly with, perhaps, only a few hours difference in time.

The reason why cloudiness has been considered by some investigators as an important factor in movement is probably because a reduction in the amount of light (cloudiness) is nearly always accompanied by a lower temperature. The factors have not been carefully separated.

Movement can not be brought about by an increase of turgor within the cells, for with a rise of 15° C. the pressure is only raised from 100 to 105.5, and this, according to Pfeffer, could not cause a movement. Fifteen degrees of temperature, Centigrade, are, in no case that I know of, necessary to effect opening, and hence sufficient power could not be obtained in this way. Experiments were made with flowers cut off from the plant to determine whether turgescence was efficient in closing them. Some were immersed in water, others in different per cents of sugar solutions—all with the same results—opening and closing at the usual times.

It seems not at all probable that the expansion of the gases in the plant could increase turgidity by the rise of temperature, and hence cause opening, since, as far as temperature is concerned, gaseous pressure and osmotic pressure are governed by the same laws. Moreover, how can night blooming flowers be explained by this theory? Lack of time prevented experimentation on such an improbable cause.

That the protoplasm of the cells within the plant could be stimulated by temperature is the last and only plausible explanation. Just how this is done can not be understood, but that flowers are positively or negatively thermotropic to certain temperature extremes seems evident. Why a certain flower is ephemeral while others are hemeranthous or nyctanthous seems to me to be only partially answerable. It is doubtless true that the character is inherent, but the original causes must have been climatic, a flower closing for biological reasons, such as protection of pollen against unfavorable weather conditions, etc., and loss of water by excessive heat. An attempt was made by Dutrochet in 1836, and Farmer in 1902, to explain movement by means of the corolla (of Taraxacum and Mirabilis in the case of the former, and of Tulipa in that of the latter). Dutrochet gives tur-

gescence as the cause. Farmer gives to a localized tissue on the outer face of Tulipa petals the power of causing the perianth to open as a result of irritation. He says the opening is, however, due to the stimulus (he does not state what, but denies epinastic and hyponastic growth here) affecting the protoplasm and producing movement. Sections that I have made through the nerves of the corolla of Mirabilis do not show the differences in structure, indicated by Dutrochet, sufficient to cause opening and closing. He states that the cellular tissue on the outside would tend to curve out by filling with water in excess—opening, the fibrous tissue on the inner side tending to curve in by oxidation—closing. Cross-sections through the nerves of the corolla of Mirabilis show about this proportion of the different tissues: 145 $\mu$ of parenchyma on the outside of the nerve, exclusive of epidermis, 72 $\mu$ of fibrous tissue, and on the inner side, 102 $\mu$ of parenchyma, exclusive of the epidermis. We could scarcely expect movements such as Dutrochet speaks of to occur as results of turgescence of the parenchymatous tissue when it is present on both sides of the fibrous tissue and in such proportions. He states also that the morning out-curving of parenchymatous tissue (opening) of the dandelion is brought about by a strong rise of sap under the influence of light, causing turgescence. The closing, he says, is due to the diminution of this force, and to the gradual filling of the fibrous tissue with oxygen during the day. This could not occur, since the osmotic pressure of the cell sap is increased only 5 per cent with a rise in temperature of 15° C., and the temperature never need change this much to induce closing; hence, some other cause must be sought.

### HEMERANTHOUS TYPE

*Experiments with Taraxacum taraxacum.* The flowers of the dandelion open from 7:00 to 8:00 A.M. in the greenhouse or in the open in May, and close from 5:00 to 6:00 P.M. On cool, cloudy days they may not open at all, and in a sudden lowering of the temperature, usually accompanied by cloudiness, as upon the approach of a storm, they may close at once. Temperature

is in all cases, however, the cause of movement, light and the humidity of the air in no way influencing it except in so far as they are necessary to the continued growth of the plant. The composite head acts as the simple flower.

*Experiments showing that light does not influence opening and closing.* Plants with buds that were ready to open, or that were open for the first time, were at 6:00 P.M. put into shade tents made of black cambric and of sufficient darkness so that there was not the slightest coloration of solio paper at 3:00 P.M. after 5 minutes exposure, when the sun was shining brightly upon the tent. The next morning, the flowers in the shade tents were open as wide as those in normal sunlight. In other experiments, the same results were obtained; in nearly every case, the temperature in the shade tent was the same as in the sunlight, or a little higher.

*Experiments showing that humidity has no direct effect upon flower movement.* Plants with flowers open one day only were used. At 5:00 P.M. after the flowers had closed, one plant, well watered, was placed in a bell jar with the sides of the bell jar wet with water and the pot standing in water. A thermometer was suspended in the jar. Another plant was placed in a bell jar, which had been dried by lying on its side in a very dry room with an air temperature of 23° C. and a relative humidity of 25 per cent. The pot was wrapped in rubber cloth so that there could be no evaporation from the pot or soil, and a flat dish filled with calcium chloride placed beside it to absorb any moisture given off. A thermometer was suspended in this jar also. The following morning, both flowers were open at 8:00 A.M., as were those left in normal conditions. The temperature in the dry jar was 27.6° C., in the moist one 25.6° C., and in the normal one 21° C. with a relative humidity of 54 per cent. The same results were obtained several times, so that this experiment also seems to prove conclusively that opening is not dependent directly upon the humidity of the air.

*Experiments showing that variations in temperature produce opening and closing.* I have been able to open and close dandelion flowers before the usual time by varying the amount of heat

present, but never to make the flowers stay open longer than usual by increasing the amount of heat to a little more than normal. The point at which opening occurs seems to be from 15° to 18° C., in the greenhouse, generally nearer the higher limit.

In the experiments which follow, relative humidities will usually accompany the temperatures, simply as additional proof that they are not influential in causing movement. For convenience, different parts of the greenhouse in which experiments were performed will be indicated, especially in those cases where the plants are transferred from one part to another to obtain the different conditions present there, thus: south house, north house, east house, middle house. The situation of plants placed out of doors will be indicated as *open,* that of those placed in the tin box with increased temperature as *warm chamber*, those placed in double walled bell jars packed with snow or ice, *cold chamber,* those in bell jars with saturated air, *moist chamber,* those in dry bell jars, *dry chamber,* while that of those in the compartment made of black cambric will be indicated as *shade tent.*

Flowers which do not open at the usual time in the morning because of low temperature, can be opened in from fifteen minutes to an hour by placing the plant in the warm chamber described on page 13.

| | | SOUTH HOUSE | | | WARM CHAMBER | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum | Condition | Temp | Rel. Hum. |
| Mar. 25, 1904 | 10:45 A.M. | ¾ open ... | 15.5°C. | 67.4% | ¾ open... | ..... | ..... |
| Mar. 25, 1904 | 11:0 A M. | ¾ open ... | ..... | ..... | Wide open | 35.5°C. | 39 4% |
| Mar. 25, 1904 | 12:00 M. | Wide open | 21.8°C. | 26% | ..... | ..... | ..... |

On March 30, 1904, a cloudy day, dandelion flowers remained closed all the morning in the greenhouse. When the temperature was artificially increased in the warm chamber, in dry air or with vapor, opening occurred as in the several cases cited below.

| | | SOUTH HOUSE | | | WARM CHAMBER | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| Mar 30, 1904 | 11:00 A.M. | Closed.... | 16° | 83% | Closed.... | 43° | Dry |
| Mar. 30, 1904 | 11:30 A.M. | Closed.... | 16° | 83% | Open ..... | 43° | Dry |
| Mar. 30, 1904 | 12:00 M. | Closed.... | 16° | 83% | Open ..... | 43° | ..... |
| April 7, 1904 | 8:00 A.M. | Closed.... | 13° | 81% | Closed.... | 29° | Dry |
| April 7, 1904 | 8:15 A.M. | Closed.... | ..... | ..... | ¼ Open .. | 29° | Dry |
| April 7, 1904 | 8:40 A.M. | Closed.... | ..... | ..... | Open ..... | 29° | Dry |
| April 7, 1904 | 11:00 A.M. | Opening . | 14.8° | 26.5% | ..... | ..... | ..... |
| April 15, 1904 | 10:00 A.M. | Closed.... | 17° | 51% | Closed.... | 20° | 39% |
| April 5, 1904 | 10:20 A.M. | Closed.... | ..... | ..... | Open ..... | 22½° | 34% |
| April 15, 1904 | 11:00 A.M. | Open ..... | 17° | 36% | ..... | ..... | ..... |

| | | SOUTH HOUSE | | | WARM CHAMBER | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| Jan. 30, 1905. | 10:30 A.M. | Bud ⅓ open | 19.8° | 63% | Bud ⅓ open | 23° | Moist |
| Jan. 30, 1905. | 10:55 A.M. | Bud ⅓ open | 19.8° | 62% | ⅓ + open.. | 25.9° | Moist |
| Jan. 30, 1905. | 11:12 A.M. | Bud ⅓ open | 20° | 60% | Open ..... | 28° | Moist |

Open dandelions when put into the cold chamber do not ordinarily close at night in the manner of those under normal conditions. They look perfectly natural and do not wither on removal, but seem to be in a rigid condition. The change from normal temperature to that of the cold chamber (19° or 21° to 2° or 5° C.) is probably so extreme that the flower is unable to react to the stimulus of the variation in temperature, for, when a plant with open flowers is put out of doors or in another room where the temperature difference is not so great, closing occurs very readily at any time of day. When the temperature in the cold chamber was not too low, closing occurred in certain instances at about the normal time.

Following are two instances of this sort with figures showing normal closing:

| | | SOUTH HOUSE | | | COLD CHAMBER | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| Feb. 22, 1905 | 9:00 A.M. | Open ..... | 19.4° | 57.5% | Open ..... | ..... | ..... |
| Feb. 22, 1905 | 10:30 A.M. | Open ..... | 25.6° | 56% | Open ..... | 10° | ..... |
| Feb. 22, 1905 | 11:30 A.M. | Open ..... | 27.3° | 51% | Open ..... | 10° | ..... |
| Feb. 22, 1905 | 2:30 P.M. | Open ..... | 31.7° | 44.5% | ⅔ closed . | 10° | ..... |
| Feb. 22, 1905 | 5:00 P.M. | ⅓ closed.. | 25° | 57% | ¾ + closed | 17° | ..... |

| | | SOUTH HOUSE | | | COLD CHAMBER | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| Feb. 27, 1905 | 10:00 A.M. | Open ..... | 24.8° | 45% | ..... | ..... | ..... |
| Feb. 27, 1905 | 10:45 A.M. | Open ..... | ..... | ..... | Open ..... | ..... | ..... |
| Feb. 27, 1905 | 12:00 M. | Open ..... | 25° | 41% | Open ..... | 12.5° | ..... |
| Feb. 27, 1905 | 1:25 P.M. | Open ..... | 26° | 38.5% | Open ..... | 12.5° | ..... |
| Feb. 27, 1905 | 3:00 P.M. | Open ..... | 25° | 35% | Open ..... | 12.4° | ..... |
| Feb. 27, 1905 | 5:00 P.M. | ⅛ closed.. | 19° | 43% | ⅛ closed.. | 14.4° | ..... |

The following data show the effect of a lowering of temperature such that closing occurs from 2 to 6 hours earlier than normal. In certain cases the lower temperature of a different part of the greenhouse was made use of, in others, the open:

| | | SOUTH HOUSE | | | EAST HOUSE | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| Jan. 21, 1905 | 10:00 A.M. | Open ..... | 18.6° | 52% | Open ..... | 12° | ..... |
| Jan. 21, 1905 | 11:00 A.M. | ..... | ..... | ..... | ¼ closed . | 14° | ..... |
| Jan. 21, 1905 | 11:45 A.M. | ..... | ..... | ..... | ⅓ closed . | 17° | ..... |
| Jan. 24, 1905 | 10:30 A.M. | ¼ open... | 13° | 43% | ¼ open... | 7.8° | ..... |
| Jan. 24, 1905 | 12:00 M | ..... | ..... | ..... | ¼ open... | 5° | 93.1% |
| Jan. 24, 1905 | 1:30 P.M. | ..... | ..... | ..... | Closed.... | 6.5° | 88.4% |
| Jan. 24, 1905 | 5:00 P.M. | ..... | ..... | ..... | Closed.... | 1.4° | ..... |
| Feb. 2, 1905 | 10:30 A.M. | ¼ open... | 18° | 55% | ¼ open... | 8° | ..... |
| Feb. 2, 1905 | 12:00 M. | ..... | ..... | ..... | ¼ open... | 10° | ..... |
| Feb. 2, 1905 | 3:00 P.M. | ..... | ..... | ..... | Closed.... | 8.6° | ..... |
| Feb. 2, 1905 | 5:30 P.M. | ..... | ..... | ..... | Closed.... | 7.5° | ..... |
| Feb. 4, 1905 | 10:00 A.M. | Open ..... | 16.8° | 58% | Not open. | 13.5° | ..... |
| Feb. 4, 1905 | 5:00 P.M. | Open ..... | 18.6° | 63% | Closed.... | 16.2° | ..... |
| Feb. 9, 1905 | 9:30 A.M. | Open ..... | 12.8° | 58% | Open ..... | 10.5° | ..... |
| Feb. 9, 1905 | 11:00 A.M. | Open ..... | 20.5° | 20% | Closing... | 13° | ..... |
| Feb. 9, 1905 | 2:40 P.M. | Open ..... | 20° | 41% | Closed.... | 14.8° | ..... |
| Feb. 9, 1905 | 5:00 P.M. | ¼ closed . | 18.2° | 63.5% | Closed.... | 9° | ..... |

| | | SOUTH HOUSE | | | NORTH HOUSE | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| Feb. 25, 1905. | 9:30 A.M. | Open ..... | 23.4° | 51% | ..... | ..... | ..... |
| Feb. 25, 1905. | 10:30 A.M. | Open ..... | 26.4° | 49% | Open ..... | 19.4° | 82.6% |
| Feb. 25, 1905. | 1:10 P.M. | Open ..... | 29.9° | 52.5% | Open ..... | 16.8° | 73.4% |
| Feb. 25, 1905. | 5:00 P.M. | Open ..... | 26.4° | 54% | ⅔ closed.. | 23° | 68.5% |

| | | SOUTH HOUSE | | | OPEN | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| Feb. 25, 1903 | 9:30 A.M. | ⅛ open... | 19° | ..... | Closed.... | 3.5° | ..... |
| Feb. 25, 1903 | 10:30 A.M. | Open ..... | 19° | ..... | Closed.... | ..... | ..... |
| Feb. 25, 1903 | 11:30 A.M. | Open ..... | 20° | ..... | Closed.... | ..... | ..... |
| Feb. 25, 1903 | 1:15 P.M. | Open ..... | 19° | ..... | Closed.... | (Taken | into green- |
| Feb. 25, 1903 | 1:45 P.M. | Open ..... | 19° | ..... | ¼ open... | 19° | [house) |
| Feb. 25, 1903 | 2:00 P.M. | Open ..... | 19° | ..... | ⅜ open... | 19° | ..... |
| Feb. 25 1903 | 2:15 P.M. | Open ..... | 18° | ..... | Open ..... | 18° | ..... |
| Feb. 25, 1903 | 4:00 P.M. | Open ..... | 18° | ..... | Open ..... | 18° | ..... |
| Feb. 25, 1903 | 5:00 P.M. | Open ..... | 17° | ..... | ¼ closed . | 17° | ..... |
| Feb. 25, 1903 | 6:00 P.M. | ⅜ closed . | 15° | ..... | ½ closed . | 15° | ..... |
| Feb. 25, 1903 | 7:30 P.M. | Closed.... | 14° | ..... | ¾+closed | 14° | ..... |
| Feb. 21, 1905 | 10:00 A.M. | Open ..... | 25° | 50% | ..... | ..... | ..... |
| Feb. 21, 1905 | 11:10 A.M. | Open ..... | ..... | ..... | Open ..... | 13° | ..... |
| Feb. 21, 1905 | 12:00 M. | Open ..... | ..... | ..... | Open ..... | 14° | ..... |
| Feb 21, 1905 | 3:00 P.M. | Open ..... | 26° | 53% | ¼ closed.. | 7.5° | ..... |
| Feb. 21, 1905 | 5:00 P.M. | ½ closed . | 20.8° | 60% | ⅜ closed.. | 6° | ..... |

| | | SOUTH HOUSE | | | OPEN | | | NORTH HOUSE | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | Cond. | Temp. | Rel. Hum. | Cond. | Temp. | Rel. Hum. | Cond. | Temp. | Rel. Hum. |
| Feb. 27, 1905 | 10:00 A.M. | Open .. | 24.5° | 45% | ..... | ..... | ..... | ..... | ..... | ..... |
| Feb. 27, 1905 | 10:30 A.M | Open .. | ..... | ..... | Open .. | 11° | 82% | ..... | ..... | ..... |
| Feb. 27, 1905 | 10:45 A.M | Open .. | ..... | ..... | Open .. | ..... | ..... | Open .. | ..... | ..... |
| Feb. 27, 1905 | 12:00 M. | Open .. | 25° | 41% | Open .. | 13° | 74% | Open .. | 21.6° | 56.2% |
| Feb. 27, 1905 | 1:25 P.M. | Open .. | 26° | 38.5% | Open .. | 12.5° | 58.4% | Open .. | 21.2° | 71.8% |
| Feb. 27, 1905 | 3:00 P.M. | Open .. | 23° | 35% | ⅜ clo'd | 13.5° | 68.4% | Open .. | 20.8° | 64.6% |
| Feb. 27, 1905 | 5:00 P.M | ⅓ clo'd | 19.4° | 4.% | Closed. | 13.5° | 53.8% | ⅓ clo'd | 17.4° | 68.9% |

| | | SOUTH HOUSE | | | OPEN | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| March 1, 1905 | 8:30 A.M. | Open ..... | 25° | 61% | ..... | ..... | ..... |
| March 1, 1905 | 9:30 A.M. | Open ..... | ..... | ..... | Open ..... | 5° | 78.4% |
| March 1, 1905 | 10:30 A.M. | Open ..... | ..... | ..... | ⅓ closed.. | 12° | 68..% |
| March 1, 1905 | 11:30 A.M. | Open ..... | 27.8° | 54.5% | ½+closed | 14° | 73.3% |
| March 1, 1905 | 2:30 P.M. | Open ..... | 27° | 47.5% | ⅔ closed.. | 16° | 52% |
| March 1, 1905 | 4:35 P.M. | Open ..... | 21.6° | 54.5% | Closed.... | 15.5° | 52% |
| March 2, 1905 | 8:35 A.M. | Open ..... | 17.2° | 60% | Open ..... | 11° | ..... |
| March 2, 1905 | 9:45 A.M. | Open ..... | 23.4° | 61% | Open ..... | 15° | ..... |
| March 2, 1905 | 5:00 P.M. | Open ..... | 24° | 40% | ⅔ closed.. | 20° | ..... |
| March 6, 1905 | 9:00 A.M. | Open ..... | 21.2° | 65.5% | Open ..... | 1.8° | 92.2% |
| March 6, 1905 | 11:00 A.M. | Open ..... | 24.5° | 66% | Open ..... | 8° | 77.5% |
| March 6, 1905 | 1:30 P.M. | Open ..... | 27.4° | 64% | ⅔+closed | 5.4° | 79.7% |
| March 6, 1905 | 3:45 P.M. | Open ..... | 20° | 62% | ¾+closed | 6° | 87.2% |
| March 6, 1905 | 5:00 P.M. | Closing... | 22° | 68.5% | ¾+closed | 6.8° | 74.4% |

| Date | Hour | SOUTH HOUSE | | | OPEN | | | NORTH HOUSE | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cond | Temp. | Rel. Hum. | Cond. | Temp. | Rel. Hum. | Cond. | Temp. | Rel. Hum. |
| Ma ch 9, 1905 | 8:45 A.M | Open . | 19 2° | 59% | Closed. | 7° | ..... | ⅛ open | 18.4° | ..... |
| March 9, 1905 | 11:00 A.M | Open .. | 23.6° | 53% | Open . | 14° | ..... | ⅛ open | 19.4° | ..... |
| March 9, 1905 | 1:30 P.M | Open .. | 24° | 38½% | Open .. | 13° | ..... | ⅛ open | 21.6° | ..... |
| March 9, 1905 | 3:30 P.M | Open .. | 22.8° | 41% | Open .. | 10° | ..... | Open .. | 18.9° | ..... |
| March 9, 1905 | 5:00 P M. | ¾ clo'd | 16° | 47½% | Open .. | 7° | ..... | Open .. | 17.2° | ..... |

Light readings also were taken by exposing solio paper to the light to show that the intensity did not influence opening or closing. Following are some data regarding the amount of light present at the times of opening and closing. If we take the tables just preceding, giving temperature and humidity values, and observe the time at which closing occurs in the different situations, and note at the same time the relative light values, light can be seen at once to be of no value in effecting closing, since it is strongest where flowers close earliest. The relative values are obtained by comparing the exposures on solio paper in a photometer, for the different situations, with a sun standard taken at noon on a certain clear day, e. g., March 21, 1905.

On February 27, 1905, dandelions were not closed in the greenhouse at 3:00 P.M. when the relative light value was .05, while out of doors they were two-thirds closed and the light value was .1. At 5:00 P.M., dandelions in the greenhouse were one-third closed with a light value of .02, while out of doors they were entirely closed, and the light was .05. In the stronger light they closed earlier.

On March 1, 1905, open dandelions put out of doors at 9:30 A.M. were one-third closed at 10:30 A.M. with a light value of .5, while indoors they were open, and the light was .1. At 4:35 P.M., those in the greenhouse were still open, with light at .03, while out of doors they were closed with light at .06.

On March 6, 1905, at 1:30 P.M., the open dandelions put out of doors at 9:00 A.M. were two-thirds or more closed, the light being .15, while indoors at the same time, where the light was .03, they were open as usual.

### OTHER HEMERANTHOUS TYPES

The flowers of *Gentiana parryi,* the large blue gentian, open for two or more days only during the day from 8:00 to 10:00 A.M. and close from 5:00 to 6:00 P.M. It is very noticeable that they do not open on cloudy, cold, or rainy days and that they close on the approach of rain. Detached flowers will stay open in the house at night but will close out of doors; if brought indoors they will open in the dark. *Gentiana acuta* behaves in much the same way, and opens at about the same time. It also stays open for almost the same number of days, possibly a little longer.

I carried on a few experiments with tulip flowers, but was unable to do much with them as they did not seem to close at night. They were forced bulbs potted for me by a local greenhouse. I did succeed in opening a few with increased temperature but not with ½° C. difference, such as Pfeffer says is possible; nor was it possible to close the flowers with either a moderate or extreme degree of cold.

### NYCTANTHOUS TYPES

*Experiments with Mentzelia nuda.* The flowers of this plant open from 3:00 to 5:00 P.M. and are closed again the following morning between 5:00 and 6:00 A.M. This is repeated for 3 to 5 days. The sepals do not close around the corolla after once opening, but stay reflexed. When first opened, the flower emits a fragrance which is lacking after a few hours, a fact probably in some way connected with pollination. On rainy days, when it is cool and cloudy, the opening is two hours or more earlier than on bright sunshiny days. The experiments which I was able to carry on were all performed in the fields, in the mountains at Halfway, Colorado. The gravel slides on which Mentzelia grows experience very great extremes of temperature on their surface: during a single day, from 10° C. between 6:00 and 7:00 A.M. to as high as 46° C. at 11:00 A.M. or 25° to 35° C. between 2:00 and 3:00 P.M. On account of this fact, I took soil samples of the gravel at the time the flowers opened or a little

before, and also a little before their closing, in order to determine whether the water-content of the soil had anything to do with the phenomenon. No differences in per cents were obtained that could be construed as influencing movement by increasing the turgescence of the cells. The per cents varied very little, from 4–5 per cent being the normal in July and August for root depth.

Rather crude experiments were also carried on to measure the amount of transpiration in shoots bearing flowers about to open, and also those about to close. Vigorous blooming shoots were cut off and placed in large test tubes well stoppered, the shoot fitting into the stopper through a split in the latter, the end resting for an inch or more in the water. The amount of water transpired was practically the same during the day and night, showing that turgescence is not the efficient stimulus.

I also tried shading the plants continuously to induce an earlier opening, but it was not possible to get a sufficient change in temperature by this means.

Relative humidities taken just at the top of the plant at the time of opening vary extremely, as also those taken at the time of closing. When the flowers were opening, relative humidity values from 17.1 per cent to 95.6 per cent were obtained between 2:45 and 6:45 P.M.; when the flowers were closing in the morning, between 6:00 and 7:00 A.M., values from 54.2 per cent to 63.8 per cent were obtained. It is evident, then, that the water-content of the air does not influence opening, as neither do water-content of the soil nor light. That temperature is the controlling factor can only be deduced from temperature readings taken at the times of opening and closing, for, as mentioned earlier in the paper, it was impossible to grow Mentzelia in the greenhouse, and in the field conditions were extremely hard to control. As to figures showing temperatures at which the flowers open in the afternoon from 2:45 to 7:45 P.M., the range is from 14¼° to 23° C., while the corresponding range of temperatures when they close in the morning is from 8° to 16.8° C.

EPHEMERAL TYPES

Only three ephemeral, day blooming flowers were experimented with: the morning glory (*Ipomoea purpurea*), the common flax (*Linum usitatissimum*), and the yellow wood sorrel (*Oxalis stricta*); the other two were night bloomers, the evening primrose (*Pachylophus caespitosus*) and the four o'clock (*Mirabilis jalapa*).

*Experiments with Ipomoea purpurea.* Ipomoea opens from 5:00 to 6:00 A.M. and closes as early as 10:00 or 11:00 A.M. when it is quite warm. (All experiments were performed in the greenhouse.) Generally, however, closing occurs between 1:00 and 3:00 P.M. Contrary to the results with the dandelion, it was always possible to keep the flowers open for a considerable time (24 hours at least) beyond the normal, by placing the plant in a temperature as low as 3 to 4° C.; also to close the flowers earlier than their time by increased temperature (28 to 32° C.) with dry air or with water vapor introduced. On the other hand, heat does not work here as a direct stimulus, but rather only to hasten the growth processes. The following tables show how closing is hindered in temperatures lower than the normal:

| | | SOUTH HOUSE | | | EAST HOUSE | | | NORTH HOUSE | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | Cond. | Temp. | Rel. Hum. | Cond. | Temp. | Rel. Hum. | Cond. | Temp. | Rel. Hum. |
| Dec. 16, 1904 | 10:30 A.M. | Open .. | 23° | 54.5% | Open .. | ..... | ..... | Open .. | ..... | ..... |
| Dec. 16, 1904 | 11:00 A.M. | Open .. | 20.7° | 53% | Open .. | 17.2° | ..... | Open .. | 17.7° | ..... |
| Dec. 16, 1904 | 12:00 M. | Open .. | 23.2° | 50.5% | Closing | 17.2° | ..... | Open .. | 17° | ..... |
| Dec. 16, 1904 | 1:30 P.M. | Open .. | 20° | 49.5% | Closing | 17.2° | ..... | Open .. | 19° | ..... |
| Dec. 16, 1904 | 3:00 P.M. | Open .. | 17.4° | 49.5% | Closing | 16.2° | ..... | Open .. | 18.9° | ..... |
| Dec. 16, 1904 | 5:00 P.M. | ⅝ clo'd | 15.4° | 50.5% | Closing | 13.8° | ..... | Open .. | 17.8° | ..... |
| Dec. 16, 1904 | 6:00 P.M. | ⅝ clo'd | 16.2° | 51.5% | Closing | 13.8° | ..... | Open .. | 17.4° | ..... |
| Dec. 16, 1904 | 9:30 P.M. | Closed. | 15° | 41% | Closed. | 13.8° | ..... | Closed. | 16.2° | ..... |

| Date | Hour | SOUTH HOUSE | | | EAST HOUSE | | |
|---|---|---|---|---|---|---|---|
| | | Condition | Temp. | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| Dec. 19, 1904 | 10:30 A.M. | Open ..... | 22° | 50% | Open ..... | 15° | 55.5% |
| Dec. 19, 1904 | 12:00 M. | Open ..... | 16° | 55% | Open ..... | 10 4° | 82.8% |
| Dec. 19, 1904 | 2:30 P.M. | Open ..... | 20° | 63% | Open ..... | 11.2° | 68.5% |
| Dec. 19, 1904 | 4:00 P.M | Open ..... | 21° | 59% | Open ..... | 11.6° | 73% |
| Dec. 19, 1904 | 6:00 P.M. | ⅗ of fls cl. | 22.6° | 57% | Open ..... | 16.4° | 63% |
| Dec. 19, 1904 | 7:00 P.M. | ⅗ of fls. cl. | 23° | 56.5% | Open ..... | 16.4° | 63 2% |
| Dec. 19, 1904 | 9:00 P.M. | All closed. | 24 7° | 55.5% | Open ..... | 17.5° | 60.8% |
| Dec. 20, 1904 | 3:30 P.M. | Bud op'ng | 13° | 58% | Bud op'ng | 10.6° | 83.2% |
| Dec. 20, 1904 | 8:00 P.M. | ..... | ..... | ..... | Open ..... | 16.5° | 81 1% |
| Dec. 21, 1904 | 10:00 A.M. | ..... | ..... | ..... | Beg to cl. | 12.2° | 88.2% |
| Dec. 21, 1904 | 12:00 M. | ..... | ..... | ..... | ¼ closed.. | 13.4° | 83.8% |
| Dec. 21, 1904 | 2:45 P.M. | ..... | ..... | ..... | ¾ +closed | 15.4° | 85.7% |

| Date | Hour | SOUTH HOUSE | | | NORTH HOUSE | | | COLD CHAMBER | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cond. | Temp. | Rel. Hum. | Cond. | Temp. | Rel. Hum. | Cond. | Temp. | Rel. Hum. |
| Feb. 25, 1905 | 9:30 A.M. | Open .. | 22.8° | 51% | ..... | ..... | ..... | ..... | ..... | ..... |
| Feb. 25, 1905 | 10:30 A.M. | ¼ clo'd | 26.4° | 49% | ..... | ..... | ..... | ..... | ..... | ..... |
| Feb. 25, 1905 | 10:35 A.M. | ¼ clo'd | 27° | 50% | Open .. | ..... | ..... | Open .. | 9° | Moist |
| Feb. 25 1905 | 1:10 P.M. | ¾ +cld | 29.9° | 52.5% | ¼ clo'd | 16.8° | 73.4% | Open .. | 7° | Moist |
| Feb. 25, 1905 | 5:00 P.M. | Closed. | 26.4° | 54% | ¾ + cl | 23° | 68.5% | Open .. | 11° | Moist |

| Date | Hour | SOUTH HOUSE | | | NORTH HOUSE | | | OPEN | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cond | Temp. | Rel. Hum | Cond. | Temp. | Rel. Hum. | Cond. | Temp. | Rel. Hum. |
| March 6, 1905 | 9:00 A.M. | Open .. | 21.2° | 65.5% | Open .. | 19.4° | 40.1% | Open .. | 1 8° | 92.2% |
| March 6, 1905 | 11:00 A.M. | Open .. | 24.5° | 66% | Open .. | 19.6° | 73.5% | Open .. | 8° | 77.5% |
| March 6, 1905 | 1:30 P.M. | ¼ clo'd | 27.4° | 64% | ¼ clo'd | 20.8° | 82.4% | Open .. | 5 4° | 79.7% |
| March 6, 1905 | 3:45 P.M. | Closed | 20° | 62% | ⅗ clo'd | 17.4° | 81% | *Chil'd | 6° | 87.2% |
| March 6, 1905 | 5:00 P.M. | Closed. | 22° | 68.5% | Closed. | 17.6° | 68% | ..... | ..... | ..... |

* Taken into the south house, where it opened in perfect condition at a temperature of 22° and a relative humidity of 68.5%.

| Date | Hour | SOUTH HOUSE | | | NORTH HOUSE | | | SHADE TENT | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cond. | Temp. | Rel. Hum. | Cond. | Temp. | Rel. Hum. | Cond. | Temp. | Rel. Hum. |
| March 8, 1905 | 8:30 A.M. | Open .. | 18.6° | 57% | Open .. | 19° | ..... | ..... ..... | ..... | ..... |
| March 8, 1905 | 10:00 A.M. | Open .. | 19 5° | 56% | Open .. | 19° | ..... | Open .. | 23° | ..... |
| March 8, 1905 | 10:30 A.M. | Open .. | 22° | 54% | Open .. | 19° | ..... | Open .. | 25° | ..... |
| March 8, 1905 | 11:45 A.M. | Open .. | 27.2° | 45% | Open .. | 19° | ..... | Open .. | 32 4° | ..... |
| March 8, 1905 | 1:45 P.M. | Nearly all cl'd | 26.8° | 50% | Closing | 20.4° | ..... | Closing | 31.8° | ..... |
| March 8, 1905 | 2:45 P.M. | Closed. | 25.8° | 46% | Closing | 20.8° | 63 2% | Closed. | 31.2° | 57.9% |
| March 8, 1905 | 4:45 P.M. | Closed. | 19.1° | 43% | Closed. | 18.5° | 69.3% | Closed. | 23° | ..... |

The third column of the last series, March 8, 1905, shows very well the negative effect of light. The tent was made of black cambric, which produced so diffuse a light that an exposure of solio paper for five minutes at 3:00 P.M. on a bright day, December 1, 1904, resulted in no coloration whatever of the sensitive paper. Here, the flowers close as early as those situated where the light is more intense.

Following are three instances out of a dozen or more showing the effect of increased temperature:

| | | SOUTH HOUSE | | | WARM CHAMBER | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum | Condition. | Temp | Rel. Hum. |
| Dec. 31, 1904 | 9:45 A.M. | Open ..... | 18° | 57% | ..... | ..... | ..... |
| Dec. 31, 1904 | 10:00 A.M. | Open ..... | 19° | 56% | Open ..... | 30° | Moist |
| Dec. 31, 1904 | 12:15 P.M. | Open ..... | 21° | 51.5% | ¼ closed.. | 37.2° | Moist |
| Dec. 31, 1904 | 2:00 P.M. | Open ..... | 23° | 45.5% | Closed.... | 37.2° | Moist |
| Jan. 11, 1905 | 9:00 A.M. | Open ..... | 22° | 60.5% | ..... | ..... | ..... |
| Jan. 11, 1905 | 10:45 A.M. | Open ..... | ..... | ..... | Open ..... | ..... | ..... |
| Jan. 11, 1905 | 11:00 A.M. | Open ..... | ..... | ..... | Open ..... | ..... | ..... |
| Jan. 11, 1905 | 12:00 M. | Open ..... | 22.4° | 61.5% | ¼ closed.. | 31° | Moist |
| Jan. 11, 1905 | 1:45 P.M. | Open ..... | 22° | 59% | Closed.... | 31° | Moist |
| Jan. 11, 1905 | 4:30 P.M. | Closing... | 20.8° | 57.5% | ..... | ..... | ..... |
| March 6, 1905 | 9:00 A.M. | Open ..... | 21.2° | 65.5% | ..... | ..... | ..... |
| March 6, 1905 | 9:30 A.M. | Open ..... | ..... | ..... | Open ..... | ..... | ..... |
| March 6, 1905 | 9:45 A.M. | Open .... | ..... | ..... | Open ..... | 23° | Moist |
| March 6, 1905 | 10:00 A.M. | Open ..... | ..... | ..... | Open ..... | 28° | Moist |
| March 6, 1905 | 11:00 A.M. | Open ..... | 24.5° | 66% | ¼ closed.. | 30° | Moist |
| March 6, 1905 | 1:30 P.M. | ¼ closed.. | 27.4° | 64% | Closed.... | 32° | Moist |
| March 6, 1905 | 3:45 P.M. | Closed.... | 20° | 62% | ..... | ..... | ..... |
| March 6, 1905 | 5:00 P.M. | Closed.... | 17° | 68% | ..... | ..... | ..... |

The relative light values may be considered here also. On February 25, 1905, at 10:30 A.M., light was 0 in the north house, and .33 in the south house; in the former the flowers were still open, while in the latter they were beginning to wither. At 1:10 P.M. in the north house, the flowers were beginning to close in darkness (0), while in the south house they were nearly closed in a light value of .33. At 5:00 P.M. in the north house, with light 0, flowers were nearly closed, while in the south house, light .01, they were entirely closed.

On March 6, 1905, at 9:00 A.M., morning glories were open in the north house with light 0, in the south house with light .012, and in the open with light .06. At 1:30 P.M., they were-

beginning to close in the north house with light .003, and in the south house with light .04, while in the open, with light .15 they were still open.

These figures all go to show that light is not effective in opening and closing flowers, for closing takes place latest in nearly every instance where there is the most light, this being where it is also coldest. The experiment of March 8, 1905, in the shade tent, given on page 27, shows that closing occurs as soon in the darkness as in the light. Morning glories, ready to open, when put in a dark tent at night and kept there all of the following day, behave exactly in opening and closing as they do in normal light with the same temperature.

It was quite noticeable that when buds ready to open were put in too low a temperature (13° or less) they did not open at all but assumed the closed position as normally after opening; the temperature was too low for the ordinary processes of life to be carried on.

*Experiments to show that humidity of the air is not the cause of opening and closing.* On November 10, 1904, at 5:00 P.M., three plants, each with buds almost open, were put into different bell jars with light and heat practically the same in all three cases. One was a moist bell jar and one a dry bell jar, with the pot wrapped in a rubber cloth, etc. Still others were left out from under the bell jars. At 8:00 A.M. on November 11, 1904, all the buds were open with a temperature of 21° C. On November 14, 1904, at 5:00 P.M., a similar experiment was performed with the same results.

*Experiments with Linum usitatissimum.* The flowers of this plant open from 5:00 to 8:00 A.M. and close from 10:00 A.M. to 2:00 P.M., or, rather, they drop their petals at that time if there is sufficient movement of the air to bring about the process. Otherwise, the petals wither and dry in place. Flax flowers can be caused to drop their petals sooner than normal by increasing the temperature. Following are tables showing the results of such experiments:

| Date | Hour | SOUTH HOUSE | | | WARM CHAMBER | | |
|---|---|---|---|---|---|---|---|
| | | Condition | Temp | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| April 6, 1905 | 9:45 A.M. | Open ..... | 26° | 38% | ..... | ..... | ..... |
| April 6, 1905 | 9:50 A.M. | Open ..... | ..... | ..... | Open ..... | 30° | Moist |
| April 6, 1905 | 10:15 A.M. | Open ..... | ..... | ..... | Open ..... | 33° | Moist |
| April 6, 1905 | 10:45 A.M. | Open ..... | 28° | 36% | Open ..... | 34.5° | Moist |
| April 6, 1905 | 11:25 A.M. | Open ..... | 28.5° | 33% | Pet. fal'ng | 35° | Moist |
| April 6, 1905 | 2:30 P.M. | Pet. fal'ng | 28° | 38% | ..... | ..... | ..... |
| April 29, 1905 | 8:35 A.M. | Open ..... | 21.2° | 36% | ..... | ..... | ..... |
| April 29, 1905 | 9:00 A.M. | Open ..... | 21.2° | 36% | Open ..... | 20° | Moist |
| April 29, 1905 | 9:25 A.M. | Open ..... | 21.5° | 35.5% | Pet. fal'ng | 24.5° | Moist |
| April 29, 1905 | 11:00 A.M. | Open ..... | 22° | 35% | ..... | ..... | ..... |
| April 29, 1905 | 12:00 M. | Pet. fal'ng | 23.5° | 32.5% | ..... | ..... | ..... |

Temperature, when lower than the normal, prolongs the existence of the flower, as is readily seen on mornings when it is cooler than usual because of cloudiness, etc. In this event, the flower lives on into the afternoon.

| Date | Hour | SOUTH HOUSE | | |
|---|---|---|---|---|
| | | Condition | Temp. | Rel Hum. |
| Feb. 1, 1905 | 8:40 A.M. | ½ open... | 10° | 62.5% |
| Feb. 1, 1905 | 12:00 M. | ¾ open... | 19° | 51% |
| Feb. 1, 1905 | 3:00 P.M. | ¾ +open. | 16.4° | 40% |
| Feb. 1, 1905 | 5:00 P.M. | Closing... | 13° | 53% |
| Mar 28, 1905 | 8:30 A.M. | Open ..... | 17.5° | 71% |
| Mar. 28, 1905 | 9:30 A M. | Open ..... | 19.1° | 59% |
| Mar. 28, 1905 | 10:20 A.M. | Open .... | 17.4° | 61% |

| Date | Hour | SOUTH HOUSE | | | OPEN | | |
|---|---|---|---|---|---|---|---|
| | | Condition | Temp. | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| Mar. 28, 1905 | 11:20 A.M. | Open ..... | 18.4° | 60% | ..... | ..... | ..... |
| Mar. 28, 1905 | 1:45 P.M. | Open ..... | 18° | 61% | ..... | ..... | ..... |
| Mar. 28, 1905 | 5:00 P.M. | Pet fal'ng | 15.6° | 62.5% | ..... | ..... | ..... |
| Mar. 24, 1905 | 10:00 A.M. | Open ..... | 27.8° | 53% | Open ..... | 22° | ..... |
| Mar. 24, 1905 | 12:00 M. | Pet. fal'ng | 26° | 51% | Open ..... | 22° | ..... |
| Mar. 24, 1905 | 2:30 P.M. | Pet fal'ng | 26.8° | 41% | Closed .... | 22° | ..... |
| May 4, 1905 | 9:55 A.M. | Open ..... | 24.5° | 32% | ..... | ..... | ..... |
| May 4, 1905 | 10:00 A M. | Open ..... | ..... | ..... | Open ..... | 12.5° | ..... |
| May 4, 1905 | 11:00 A.M. | Open ..... | 25° | 35% | Open ..... | 12.5° | ..... |
| May 4, 1905 | 12:00 M | 1 flr. with fall'g pets. | 24.5° | 36% | Open ..... | 14.5° | ..... |
| May 4, 1905 | 1:30 P.M. | All petals falling... | ..... | ..... | Open ..... | 16° | ..... |
| May 4, 1905 | 2: 0 P.M. | All petals falling... | 23.4° | 31.5% | Closing... | 17° | ..... |

In the following instance opening was not complete at any time during the day:

| | | SOUTH HOUSE | | |
|---|---|---|---|---|
| Date | Hour | Condition | Temp | Rel. Hum. |
| April 10, 1905 | 10:00 A.M. | Opening a trifle .... | 12.6° | 60% |
| April 10, 1905 | 1:30 P.M. | Opening a trifle .... | 12.8° | 68% |
| April 10, 1905 | 4:30 P.M. | Opening a trifle .... | 20.5° | 70% |

This late closing is always associated with a late opening in the morning accompanied by a low temperature.

*Experiments with Oxalis stricta.* The flowers of *Oxalis stricta* open from 9:30 A.M. to 11:00 A.M., and close for the first and only time between 1:30 and 3:00 P.M. The same phenomena are to be observed as in the other ephemeral day blooming species studied, i. e., a low temperature hinders opening and also prolongs it when there has been a temperature high enough to induce opening. Opening can be made to occur earlier than normal also, as in the case of the other flowers studied, by increasing the amount of heat to a few degrees above the normal. As evidences of the effect of low temperatures on the time of opening, the following figures are conclusive. Table I shows the normal condition of the flowers under normal temperatures; table II, the effect of a lower temperature continuing more or less throughout the day:

I.

| Date | Hour | Condition | Temp. | Rel. Hum. |
|---|---|---|---|---|
| March 21, 1905 | 8:30 A.M. | Not open | 22.4° | 50% |
| March 21, 1905 | 9:30 A.M. | ½ open | 24.6° | 54% |
| March 21, 1905 | 11:30 A.M. | Open | 27.2° | 54% |
| March 21, 1905 | 1:30 P.M. | Only 2 flowers still open. | 28.4° | 50% |

II.

| Date | Hour | Condition | Temp. | Rel. Hum. |
|---|---|---|---|---|
| March 28, 1905 | 8:30 A.M. | Not open | 17.5° | 71% |
| March 28, 1905 | 9:30 A.M. | ⅛ to wide open | 19.1° | 59% |
| March 28, 1905 | 10:20 A.M. | ⅛ open | 17.4° | 61% |
| March 28, 1905 | 11:20 A.M. | ⅛ open | 18.4° | 60% |
| March 28, 1905 | 1:45 P.M. | Open | 18° | 61% |
| March 28, 1905 | 5:00 P.M. | Closed | 15.6° | 62.5% |

The effect of a temperature slightly higher than normal in inducing a more rapid opening is shown by the following table:

| | | SOUTH HOUSE | | | WARM CHAMBER | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum. | Condition | Temp | Rel. Hum. |
| April 26, 1905 | 9:30 A.M. | Not open. | 25.3° | 57.5% | ..... | ..... | ..... |
| April 26, 1905 | 10:15 A.M. | Not open. | 23° | 60% | Not open. | 22° | Moist |
| April 26, 1905 | 10:40 A.M. | ⅛ open... | 16.2° | 63% | ⅜ open... | 22° | Moist |
| April 26, 1905 | 10:45 A.M. | ⅛ + open. | 14.5° | 74% | 1 flr. wide open..... | 27.5° | Moist |
| April 26, 1905 | 11:00 A.M. | ⅜ + open. | 14.8° | 63% | All flow'rs wide open | 27.5° | Moist |
| April 26, 1905 | 11:15 A.M. | Open ..... | 14.5° | 64% | ..... | ..... | ..... |
| April 29, 1905 | 8:35 A.M. | Not open. | 21.2° | 36% | ..... | ..... | ..... |
| April 29, 1905 | 9:00 A.M. | Not open. | 22° | 34% | Not open. | 21° | Moist |
| April 29, 1905 | 9:25 A.M. | 1 flower ⅜ open... | 23.5° | 31% | All open.. | 24.5° | Moist |
| May 3, 1905 | 8:40 A.M. | Not open | 22° | 82% | Not open. | 22° | Moist |
| May 3, 1905 | 9:20 A.M. | ⅛ open ... | 22.6° | 78% | Wide open | 26.8° | Moist |
| May 3, 1905 | 9:40 A.M. | ⅜ open ... | 23.2° | 77% | Wide open | 26.8° | Moist |

That Oxalis flowers should not yet be open at 8:35 A.M., April 29, 1905, and at 8:40 A.M., May 3, with the same temperature or practically so, 21.2° and 22°, and the light practically the same, shows that the widely different relative humidities do not count for much, 36 per cent in the first instance, and 82 per cent in the other. Opening occurs at practically the same time, 9:30 A.M., with temperature and light the same, but the relative humidities still widely different, 31 per cent and 78 per cent.

Several experiments, a half dozen at least, relative to the effect of light in opening flowers, show, as for the other flowers experimented upon, that opening occurs as well when plants were put into the shade tent as when in the open with full light.

EPHEMERAL TYPES

### *Night bloomers*

*Experiments with Pachylophus caespitosus.* Field conditions, rather than controlled experiments, were made use of here to obtain information as to sleep movements, since it was impossible to grow the plants in the greenhouse. The plant as observed grew on the gravel slides of the mountains around Halfway, Colorado. Its delicate fragrant white flowers open from 4:50 P.M. to 8:00 P.M., and close from 10:00 to 11:00 the next morning, when they become a dull pink color. It often happens that the flower stays open the entire day when it is cool and cloudy, and, rarely, on to the next day. The early or late opening in the evening is not due so much to the immediate temperatures as to those that have prevailed during the day, thus enabling growth to go on faster and opening to occur sooner. This is shown by the varied temperatures at which opening and closing occur. On certain days, the flowers are still open in the morning when the temperature rises as high as 31°, while in other cases they are closed when the temperature is as low as 13.5° C. or as high as 23.5° C. Opening in the evening occurs when the temperature is as high as 19.5° C. while, when it remains as low as 16.5° C., they may still remain unopened.

Plants copiously watered showed no earlier opening than those normally treated.

*Experiments with Mirabilis jalapa.* In the greenhouse, in March and April, these flowers stay open until noon or after, sometimes 2:00 or 3:00 o'clock, but occasionally are closed or almost closed by 10:30 A.M. when the day has been warm and bright. The opening almost never occurs at 4:00 o'clock, as tradition goes, but at 6:00 or 9:00 o'clock or later. It is possible to prolong the period of opening by lowering the temperature below the normal. This is illustrated by the following tables:

| | | SOUTH HOUSE | | | NORTH HOUSE | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| April 15, 1903 | 10:00 A M | Open ..... | 12.8° | 55% | ..... | ..... | ..... |
| April 15, 1903 | 10:15 A.M. | Open ..... | 13° | 50% | Open ..... | 12.5° | 51% |
| April 15, 1903 | 10:30 A.M. | Open ..... | 17.4° | 41.5% | Open ..... | 12.5° | 61% |
| April 15, 1903 | 11:05 A.M. | Open ..... | 17° | 16% | Open ..... | 13° | 33% |
| April 15, 1903 | 12:00 M. | ⅓ closed.. | 21° | 28% | Open ..... | 14.5° | 49% |
| April 15, 1903 | 2:30 P.M. | Closed .... | 25° | 26% | ⅓ closed.. | 13° | 35% |
| April 15, 1903 | 3:00 P M. | Closed .... | 26° | 26% | ⅓ closed.. | 13° | 62% |

| | | SOUTH HOUSE | | | EAST HOUSE | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| Jan. 24, 1905 | 10:30 A.M. | Open ..... | 13° | 43.5% | Open ..... | 7.8° | ..... |
| Jan. 24, 1905 | 12:00 M. | ..... | ..... | ..... | Open ..... | 5° | 93.3% |
| Jan. 24, 1905 | 1:30 P.M. | ..... | ..... | ..... | Open ..... | 6.5° | 88.4% |
| Jan. 24, 1905 | 3:15 P.M. | ..... | ..... | ..... | Open ..... | 1.6° | ..... |
| Jan. 24, 1905 | 5:00 P.M. | ..... | ..... | ..... | Open ..... | 1.4° | ..... |
| Jan. 25, 1905 | 11:30 A.M. | Open ..... | 21.4° | 42% | ..... | ..... | ..... |
| *Jan. 25, 1905 | 2:20 P.M. | Closed .... | 25.8° | 30% | ..... | ..... | ..... |
| Feb. 2, 1905 | 10:30 A.M. | Open ..... | 18° | 55% | Open ..... | 8° | ..... |
| Feb. 2, 1905 | 12:00 M | ..... | ..... | ..... | Open ..... | 10° | ..... |
| Feb. 2, 1905 | 3:00 P.M | ..... | ..... | ..... | Open ..... | 8.6° | ..... |
| Feb. 2, 1905 | 5:30 P.M. | ..... | ..... | ..... | ⅓ closed.. | 7.5° | ..... |

*The flower which was open on the morning of January 24, 1905, was still open the next morning at 11:30 A.M., but closed at 2:20 P.M.

When the temperature is raised above the normal, closing can be brought about earlier than usual, a fact shown by the following table:

| | | SOUTH HOUSE | | | WARM CHAMBER | | |
|---|---|---|---|---|---|---|---|
| Date | Hour | Condition | Temp. | Rel. Hum. | Condition | Temp. | Rel. Hum. |
| April 15, 1904 | 10:00 A.M. | Open ..... | 12.8° | 55% | Open ..... | 17° | 51% |
| April 15, 1904 | 10:20 A.M. | Open ..... | 16° | 51% | ¾ closed.. | 22.5° | 34% |
| April 15, 1904 | 10:30 A.M. | Open ..... | 17.4° | 41.5% | ..... | ..... | ..... |
| April 15, 1904 | 11:05 A.M. | Open ..... | 17.6° | 16% | ..... | ..... | ..... |
| April 15, 1904 | 12:00 M. | ⅓ closed.. | 21.4° | 28% | ..... | ..... | ..... |
| April 15, 1904 | 2:30 P.M | Closed .... | 25° | 27% | ..... | ..... | ..... |
| April 29, 1905 | 8:35 A.M | Open ..... | 21.2° | 36% | ..... | ..... | ..... |
| April 29, 1905 | 9:00 A.M. | Open ..... | 22° | 35% | Open ..... | 20° | Moist |
| April 29, 1905 | 9:25 A.M. | Open ..... | 23.5° | 34% | Closing... | 24.5° | Moist |
| April 29, 1905 | 10:30 A.M. | Open ..... | 24.2° | 34% | Closed.... | 24.5° | Moist |
| April 29, 1905 | 12:00 M. | Closing... | 25° | 32% | ..... | ..... | ..... |

Humidity in no way influences closing as evidenced by the following:

| Date | Hour | MIDDLE HOUSE | | | MOIST CHAMBER | | | DRY CHAMBER | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cond. | Temp. | Rel. Hum. | Cond. | Temp. | Rel Hum. | Cond. | Temp. | Rel. Hum |
| April 15, 1904 | 10:00 A.M. | Open . | 12.8° | 55% | Open .. | 16.8° | 66% | ..... | ..... | ..... |
| April 15, 1904 | 10:30 A.M. | Open .. | 17.4° | 41.5% | Open .. | ..... | ..... | ..... | ..... | ..... |
| April 15, 1904 | 11:05 A.M. | Open .. | 17° | 16% | Open .. | ..... | ..... | ..... | ..... | ..... |
| April 15, 1904 | 12:00 M. | ⅛ clo'd | 21.4° | 28% | ⅛ clo'd | ..... | ..... | ..... | ..... | ..... |
| April 15, 1904 | 2:30 P.M. | Closed. | ..... | ..... | Closed. | ..... | ..... | ..... | ..... | ..... |
| April 20, 1905 | 10:00 A.M. | Open .. | 15.4° | 57.5% | Open .. | 14.5° | ..... | Open .. | 14.5° | ..... |
| April 20, 1905 | 11:30 A.M. | Open .. | 16.8° | 55.8% | Open .. | 15° | ..... | Open .. | 14 5° | ..... |
| April 20, 1905 | 3:00 P.M | Open .. | 16.2° | 51% | Open .. | 16.8° | ..... | Open .. | 15.4° | ..... |

Variations in the amount of light present do not seem to affect closing, for, when a plant with open flowers is put into the tin box with increased temperature, and practically no light, except the small amount from the non-luminous alcohol flame, closing occurs as readily as in the open, if not more so. Opening and closing also occur as in the open when the plants are put in the black shade tents. Closing may take place at as low a degree of temperature as 7.5° C., when the flower has been kept open beyond its usual time by several hours, as in the case cited on page 34, for February 2, 1905. This is to be explained on the basis that, since the flower's existence is normally only one day or a part of it, the flower has remained open its usual time according to its hereditary habits, its activities were completed, and hence closing occurred. Whenever closing occurs in the morning between 11:00 and 12:00, the temperature is nearly always 19° to 26° C., while, when it is delayed until 2:00 to 4:00 P.M., it is as low as 13° or 17° C. with high humidities, showing that it is not the extremely low temperature, but the constantly low temperature, continued for a considerable time, which is the cause of the late opening.

## SUMMARY

I have been able to control the opening and closing of dandelion flowers in so far that I can close them permanently with lower temperature than normal, and open them when temperature has continued too low, by the application of either dry or moist heat. It is also possible to close any ephemeral flower be-

fore its time by an extra amount of heat, with either dry or moist air. It is impossible, however, to open an ephemeral flower by placing the plant in a lower temperature, since this checks growth, and opening is here rather a growth movement than a stimulatory one as in the other types.

In the careful study by experiment of *Taraxacum taraxacum, Mentzelia nuda, Ipomoea purpurea, Linum usitatissimum, Oxalis stricta, Mirabilis jalapa,* and *Pachylophus caespitosus,* light, humidity of the air, and water-content of the soil have been successfully eliminated as possible physical factors likely to cause the opening and closing of flowers by the movement of the petals (or florets). Heat, on the other hand, by its variations during twenty-four hours, is the direct cause of movement in hemeranthous and nyctanthous types that bloom for more than one day. In the case of those ephemeral flowers which open very early in the morning before the temperature has risen to any extent, as the morning glory, in contrast to those like purslane which open as the temperature rises, or those like the evening primrose which open a short time after the higher temperatures of the day have given place to the lower ones of night, the phenomenon is not to be explained so easily; it is possible that they react to a smaller variation in temperature than do the others mentioned.

The closing of ephemeral flowers is, however, a different process from that of periodic flowers, since it signifies the end of the existence of the flower. This closing, as has been shown, can be delayed for several hours by a temperature constantly lower than normal, showing that the two are closely connected. It would seem to be a tenable theory that ephemeral types of flowers have arisen by an extra need for protection of the flower against excessive heat and evaporation, e. g., in a dry or warm climate, for it is true in nearly every instance that the ephemeral type of flower either blooms at night or for only a few hours during the day. The differentiation into these types in the past generations must have come about in some such way, and they have persisted because of this favorable adaptation.

The cause of the periodic movements of hemeranthous and nyctanthous types is, however, explainable through the influence

of variations in temperature, acting, not through turgescence, but by stimulation of the protoplasm.

To Professor Doctor C. E. Bessey and Professor Doctor F. E. Clements, under whose guidance the work embodied in this thesis has been carried on, I owe my most sincere thanks for encouragement and for suggestions and advice concerning instruments and methods of experimentation.

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## II.—*On the Conflict of Parties in the Jacobin Club (November, 1789–July 17, 1791)*

BY CHARLES KUHLMANN

The Breton Club having ceased its activity after the discussion of the veto in August, 1789, the popular party in the assembly found itself without a rallying point. Although differences of opinion had shattered the loosely organized club at Versailles, the memory of its usefulness soon induced the same members to attempt the formation of a new and more regularly organized association in the capital.[1] The exact date of the formation of the Jacobin Club it is impossible to determine from the evidence so far discovered, but everything points to the close of November or the first days of December, 1789, as the period during which the first meetings were held. From a letter of Boullé, deputy of Pontivy, dated December 18,[2] we learn that the society had recently been formed but had existed long enough to have received numerous requests for correspondence from provincial societies.[3]

[1] For the fate of the Breton Club, see my article in the *University Studies* for October, 1902, pp. 77–87. For the condition of the popular party at the time when the Jacobin Club was formed, see the letter of Boullé cited below. This letter also practically disposes of the controversy as to the origin of the new club. Some of the members lat denied that the Breton deputies were the founders, and while Boullé's letter does not prove that his colleagues from Bretagne were alone concerned, it shows that the Jacobin Club was looked upon at the time of its formation as a continuation of the Breton Club. For the controversy see Aulard, *La société des Jacobins*, I, xvii–xxi, cited as "Aulard" in the following pages.

[2] Kerviler, *Recherches et notices*, art. Boullé. The letters of Boullé are now in the archives of Morbihan.

[3] That the club had not yet been formed on November 18, we may conclude as practically certain, for in the *Observateur* of that date a certain Imbert, who had been asked by the editor, Feydel, to urge the formation of a *Society of the Revolution*, expresses surprise that no one had as yet thought of such a thing. Imbert sent three louis to Desenne as a subscription for the formation of such a society and invited others to do the same. As Imbert seemed well informed and as Desenne's was a place where the

This new organization adopted the name of "Society of the Revolution" which it soon changed to "The Society of the Friends of the Constitution."[1] The name "Jacobin" was unofficial before September 21, 1792, and was given it by the public who knew it as the society which met in the Jacobin convent.[2] A formal constitution or *réglement* was voted on February 8, 1790, entrance cards and initiation fees required, and persons not members of the National Assembly freely admitted.[3] Preparation for the debates in the National Assembly, which had been practically the sole object of the Breton Club, was only one of the objects of the new society. Its aim was nothing less than the conversion of the whole of France to the support of the revolution. It was the center of an enormous propaganda, with secondary centers in all the principal cities of the kingdom, and soon spreading into the villages and even the country districts.[4] Three large standing committees were appointed, meeting on fixed dates as deliberating bodies. These were the committees on membership, correspondence, and administration.[5]

The Jacobin Club is not to be regarded as a party in the usual sense of the term, for it was not composed of men holding the same views upon the questions of the hour. Its members were not required to subscribe to any specific political faith. They promised merely to uphold the revolution as it had been or was

deputies frequently gathered for consultation, it is not likely that this movement would have been undertaken had the *Society of the Revolution* already existed. On the other hand, for the Jacobin Club to have become known in the provinces and have received requests for correspondence from there by the 18th of December argues that it had already existed for several weeks. Barnave, author of the Jacobin constitution, in a letter of June 25, 1790, gives the close of November as the time when the society was founded.

[1] This name is given in the constitution of February 8, 1790, Aulard, I, xxviii xxxiii.

[2] Aulard, I, xxii.

[3] See constitution of the club, and Aulard, I, note 1, p. xxx.

[4] See preamble to the constitution and Aulard, I, lxxxii–lxxxix, where a list of the affiliated societies down to June 19, 1791, is given, a list which is probably very incomplete.

[5] For the membership of these committees on May 1, 1791, see Aulard, I, lxxvii lxxix. How extensive the work of administration became in 1791, and the formal manner in which these committees proceeded may be learned from the *Procès-verbaux des séances du comité d'administration de la société des amis de la constitution*, etc., *Archives Nationales*, F.[17]4350 M.SS.

still to be expressed in the work of the National Assembly.[1] This by no means implied that all its members were necessarily satisfied with the solution of every question so far treated by the assembly, but that as a matter of policy they acquiesced. Difference of opinion was often as violently expressed in the club as in the assembly. It is equally misleading to use the terms "Jacobin" and "revolutionary" as synonymous, as Ferrières so frequently does,[2] for the society never contained all the deputies in sympathy with the revolution and it certainly was not responsible for the whole revolution. It was by such loose terminology that the enemies of the club attempted to render it responsible for every radical measure or popular disturbance.[3]

At the close of November, 1789, when the society was organized, the grouping into parties in the assembly had hardly passed beyond a loose division into left and right. As the work proceeded, the men of various temperaments were attracted about their respective centers of affinity, a process which very soon made itself apparent among the Jacobins. That discontent existed in the right wing of the club as early as January, 1790, is to be inferred from the negotiations of Malouet with Liancourt-Larochfoucauld, Lafayette, and others for the formation of a more moderate society, the "Impartials."[4] Malouet did not succeed, but some of the men he sought to detach from the Jacobins soon discovered their tendency in entering the "Club of '89." Throughout the whole duration of the assembly there was a constant loss of members from the right of the club and a corresponding gain on the left, a tendency which largely explains its passage from a moderate to a radical organization.

This process was, from its positive side, largely the result of necessity. Calumniated by its enemies, the society was forced to take the public to some extent into its confidence. As it was the

[1] See the constitution of the club, Aulard, I, xxviii–xxxiii.

[2] *Mémoires, passim.*

[3] This was the usual practice of the pamphleteers. See pamphlets published by Aulard in volumes one and two.

[4] For these negotiations see *Révolutions de France et de Brabant*, No. 8, 1790, *Journal des impartiaux*, No. 1, and *Mémoires* of Malouet, I, 374–81.

intention of the deputies to prepare themselves for the discussions in the National Assembly they could not well admit friends and enemies alike, even as mere spectators. So, to allay the suspicions of the people of Paris, they received into membership an ever-increasing number of citizens who by their character and reputation would discredit all evil reports.[1] But this policy, very fatal to the society in the end, contributed in March, 1790, to bring about the revolt of some one hundred and twenty deputies who were offended at the influence non-deputies were thus enabled to exercise upon the decisions of the National Assembly. These secessionists established themselves in a rival club at the house of the Comte de Crillon, holding its meetings upon the same days and hours as those of the Jacobins, and admitting all members of the latter society who were at the same time deputies to the National Assembly. This greatly alarmed the Jacobins, who began at once to make overtures of peace. On March 15, 1790, Charles Lameth, then president of the society, followed by a large number of members, appeared at the Crillon assembly and besought its members earnestly to return in the interest of unity among the patriots. They promised that thereafter two or three sessions a week should be held from which non-deputies would be excluded. What agreement was finally reached—certainly not the one here proposed—we do not know, but the efforts of the Jacobins were successful in bringing the schism to an end.[2]

But the presence of non-deputies was not the only cause that had driven some of the members of the National Assembly from the society. The Lameths and their friends had already begun to exercise more influence than some were able to endure. So severe was the personal strife, that Charles Lameth declared the Comte de Crillon and Larochfoucauld to be "vile courtisans."[3] It was supposed, too, by some that the society was directed by a secret committee composed of Barnave, the Lameths, D'Aiguillon, Duport, Labord, and Baron Menou, who assembled at a place in the Rue Saint-Nicaise or Basse-du-Rempart. This con-

[1] Dubois-Crancé, *Analyse de la révolution française*, p. 51, cited by Aulard, I, xix.

[2] Duquesnoy, *Journal*, I, bulletin of March 16, 1790.

[3] *Ibid.*

jecture, entered by Duquesnoy under date of March 16, 1790, is frequently repeated by the enemies of the Jacobins as a fact, but our trustworthy sources give no evidence of the existence of a formally organized committee of this nature.[1]

Hardly had the Crillon difficulty been disposed of before the long debate in the National Assembly upon the judicial system began, creating a new division in the popular party. Adrien Duport, rejecting the report of the committee on the constitution, toward the close of March, read a plan of his own which the society officially approved by printing it. On March 30, it was attacked in the society itself, after Loyseau had on the 24th read a long and favorable commentary on it.[2] The point of greatest difficulty was whether or not juries should be introduced in civil cases as Duport had proposed. Barnave, the Lameths, and Robespierre warmly seconded Duport against the advocates and procurers who almost to a unit opposed it. In spite of the violence of Charles Lameth, who declared that he would oppose the aristocracy of the advocates as he had opposed the other aristocrats, and the talk of despotism and counter-revolution, the party of Duport was defeated.[3] But the debate had beyond question driven a number of deputies from the club.

It was at this time that the "Triumvirate," composed of Barnave, Alexander Lameth, and Adrien Duport, established their supremacy in the society. The formation of the "Club of '89" about this time contributed to this result by removing a large number of deputies who would have opposed them had they remained. Their power in the club and in the assembly was attested by the fury with which their enemies attacked them. From May or June, 1790, to March, 1791, innumerable pamphlets and articles in the newspapers were directed against them

[1] Duquesnoy, *Journal*, I, bulletin for March 16, 1790.

[2] Aulard, I, 42–58, speech of Loyseau.

[3] The discussion on the jury system is somewhat fully reported in the *Correspondance de MM. les députés des communes de la province d'Anjou*, IV, Nos. 22 and 23. Ferrières says that the *avocats* were a disturbing element among the "revolutionists" at this time. Robespierre claims that the *avocats* acted as a unit against the jury in criminal cases. *Mémoires authentiques de M. de Robespierre*, Paris, 1830, II, 66. See also *Chronique de Paris*, No. 98, 1790.

with no apparent effect other than to increase their popularity.[1] Duport, former member of the *Chambre des Enquêtes* of the Parliament of Paris, came to the National Assembly with his reputation as an opponent of the government already made.[2] Possessed of considerable organizing talent, he supplemented the work of the intriguer Lameth and the oratorical powers of the proud but incisive advocate of Grenoble, Barnave, who, although very soon remarked, made his reputation upon the committee on colonies and in his famous debate with Mirabeau.

As another group in the society, the friends of the Duc d' Orleans are sometimes cited. Not infrequently the enemies of the club charged it with being in the pay of this notorious character or with working in his interests.[3] As the duke was a popular character, it is certain that many members of the club were favorably disposed toward him, but nothing worthy the name of evidence has been found showing that the club, during this early period of its existence, ever contemplated putting him forward as against the ruling branch of the family. His son was a popular member of the society,[4] and Desmoulins early in 1790, speaking of the imminent return of the Duc d' Orleans from England, addressed him in one of the numbers of his "Révolutions de France et de Brabant," in his half-bantering tone, urging him to go to the Jacobins where he would be gladly received.[5] Laclos, the editor of the Jacobin journal of correspondence, was held to be an agent of the duke secretly working for his interests at the

[1] *Chronique de Paris*, No. 174. Pamphlets published by Aulard, in volumes one and two.

[2] He was one of the principal opponents of the government during the parliamentary revolution of 1787–1789, and gave his name to a revolutionary club of this period, the *Comité Duport*.

[3] Pamphlet, *Le carnaval Jacobite*, Aulard, II, 154–65; *Les chefs des Jacobites*, I, 1–9.

[4] Aulard, I, 325.

[5] No. 8. "Dans un moment où Malouet et les ministres veulent mener le roi aux Augustins, c'est pour nous une affaire capitale d'entraîner son frère aux Jacobins. En conséquence, le procureur général de la lanterne ne se souvient plus que de ces paroles du prophete: *Quand vous seriez rouge comme l'écarlate, t us vos péchés seront lavés, et vous serez blanc comme neige si vous venez aux Jacobins.* Mais il faut renvoyer madame Balbi d'où elle est venue. Alors *noster eris*, et nous vous ferons président des Jacobins honneur qui vaut bien celui d'être frère du roi."

club.[1] On the other hand, Mirabeau, who was probably in position to know, declared in his seventh note to the king that the Duc d' Orleans had never been anything to the Jacobins.[2]

Although the society was, almost from the moment of its birth, accused of violence and agitation for selfish motives,[3] it was not until November, 1790, that such charges could be made with entire justice. Until that time the reports of the meetings of the society indicate that the discussions were orderly in outward form and sane in content. Formal papers, dissertations by scholars or educated men, predominated during the first period of its existence. Questions confronting the National Assembly were discussed in an exhaustive way, by considering them in their fundamental elements. This mode of debate, which, it must be understood, was never the exclusive practice, gave place gradually to more impromptu efforts by less intelligent disputants.[4] The society naturally became more irresponsible as the more moderate deputies and scholars withdrew, a process which has been described above.

Alexander Lameth, no doubt with a desire of shielding himself and his friends, ascribes the violence of the Jacobins to the policy of "pessimism" adopted by the court in filling the society with hotheads for the purpose of discrediting it.[5] How much truth there is in this, it is difficult to determine, but it seems that the plan was at least seriously considered. It is only a part of Mirabeau's greater scheme for destroying the National Assembly by driving it to extremes.[6] It is certain that the Jacobins at the beginning of 1791 believed that traitors had been introduced among them so that for a long time they considered the advisa-

[1] Michelet claims that Laclos as editor of the *Journal des amis de la constitution* used this newspaper in the interest of the duke. I confess I can not see the slightest evidence of this, especially since Laclos did little beyond publishing extracts from the correspondence of the affiliated societies.

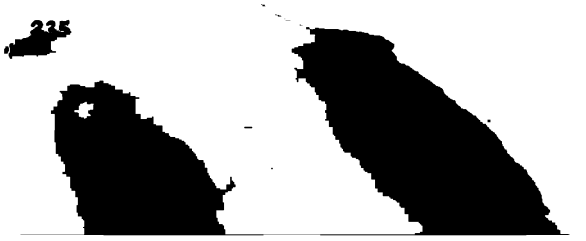
[2] Bacourt, *Correspondance entre le Comte de Mirabeau et le Comte de la Marck*, II, 70. Cited in the following pages as "Bacourt."

[3] Aulard, I, 1–9.

[4] This tendency is very noticeable in the sources published by Aulard, volumes one and two.

[5] *Histoire de l'assemblée constituante*, I, 424–25.

[6] Bacourt, II, note 43.



bility of taking a vote of purification (*scrutin épuratoire*)[1] and that Desmoulins defended the moderation of Barnave in the address he had drawn up for the affiliated societies in March, 1791, on the grounds that its enemies were trying to destroy the society by means of its own excesses.[2]

But aside from these causes at work in destroying the moderation of the Jacobins, there were others more positive in their character and better established by evidence than is the assertion of Lameth. In the first place, toward the close of 1790 the atmosphere became overcharged with rumors of counter revolution which poured into the club from the affiliated societies and were spread in endless profusion by the papers of Desmoulins, Fréron, Carra, Prud'homme, and others. What more natural than that the Jacobins also should take fire? In the second place, Barnave has made an extremely important and instructive confession, one fatal to Lameth's statement, so far as its defensive character is concerned. He and his friends having for some time been occupied with committee work, Barnave found, upon his return to the general discussions, that the confidence the National Assembly had had in him and his popularity at large had been greatly weakened. To regain his lost ground he began his career of denunciation, so evident in December, 1790, and January, 1791, and which drew upon him and his friends the most venomous attacks of the pamphleteers and the opposing press.[3]

Until about April, 1791, Barnave and his friends succeeded in maintaining their ascendency over the Jacobins, carrying the mass of the members with them in their fury of denunciation. Whether any members actually abandoned the society because of these excesses, as was claimed at the time, is difficult to determine, but it can not be doubted that many of its friends were disappointed and that it was ultimately injurious to the reputation of the society. Before the leaders became convinced of the pernicious influence they exercised, their enemies fell upon them with a fury even greater than their own. While some attacked

[1] *Journal des amis de la constitution*, III, No. 35, note p. 330.
[2] *Révolutions de France et de Brabant*, VI, No. 68, 166.
[3] See pamphlets published by Aulard in volume two.

the society as a whole, others absolved the majority of its members, while fixing the blame upon the "Triumvirate."[1] These latter, like Mirabeau and Montmorin, set themselves the task of destroying the power of the leaders in the club, after which the other members might perhaps be directed to better objects.[2] As long as this attempt was evident as the work of the reactionary party, it could not fail to have an effect exactly the contrary to the one intended, for to be the object of attack from this quarter was to be designated as a good patriot. Much more dangerous were the maneuvers led by Mirabeau, aided by Montmorin and La Marck. Duport and Alexander Lameth, in their violent attack upon Mirabeau on February 28, 1791, had intended to drive him from the club, but failed completely. A burst of applause greeted Mirabeau's reply to his opponents, and his correspondence shows that he did not consider himself defeated.[3] He knew that the position of the Lameths and their friends was not at all secure and that their very violence evidenced their embarrassment.[4] But on March 2, an extremely clumsy act of Duquesnoy spoiled everything. Like Mirabeau and many others, Duquesnoy had been denounced by Lameth on the 28th of February and now had the evil inspiration of replying in a letter to the Jacobins, which seemed to them to divulge the plan they had so long suspected, namely, that an attempt was being made to divide the society. Duquesnoy openly praised the majority of the members but severely took to task the Lameths and their friends. "I will tell you, then," he wrote, "with the frankness appropriate for all, that the most dangerous enemies of liberty are those who, like M. Lameth, concealing a profound ambition under the mask of patriotism, regard the people only as a ladder upon which to mount to power. . . . The insupportable despotism of the MM. Lameths and of several of their friends has driven from

[1] See pamphlets published by Aulard in volume two.

[2] Bacourt, II, 384, note 45, December 4, 1790, and III, Mirabeau to La Marck, March 4, 1791, 78.

[3] See the debate on the 28th of February, 1791, in Aulard, II, 95–113.

[4] Bacourt, III, note 49, January 17, 1791. La Marck thought the Jacobin leaders on the verge of overthrow even in December, 1790. Letter to Mercy-Argenteau, December 30, 1790, Bacourt, II, 530.

your society some very ardent friends of liberty; the more one loves it [liberty], gentlemen, the more one hates every kind of domination; I call your own proud souls to witness. . . . Public opinion seems to-day to judge the men of whom I speak; when it shall be more strongly expressed, when those who dishonor your society shall be more universally judged, you will see all the friends of liberty reunite themselves to you, and the party spirit which now divides us and causes the misfortune of France will cede to the irresistible force of public spirit. . . . I have not in my whole life advanced a single principle, a single fact, which I ought to disavow. I place before you the most formal defiance for M. Lameth to cite a single one. I shall reply categorically to each one of them. I know my crime towards him: I have disdained to incline my head before his pride; I have loved for itself a revolution which gives me my rights and my happiness; I have refused to believe that it was the work of M. Lameth, and I have dared to say so. I know at what price I might have pleased him: I might have consented that the general system of liberty should receive a few exceptions in his favor."[1]

When Mirabeau learned of this he was in despair. "What I foresaw," he wrote to La Marck, "has happened; the letter of Duquesnoy received at the Jacobins, I absent, raised them to the diapason of fury, and furnished M. Barnave the occasion for making a long enumeration of the services the MM. Lameth have rendered to the revolution, and to declare that they will perish together. Hence an ecstatic choir of applause, hence an insolent reply, hence especially the detestable consequence of uniting the Jacobins to their leaders instead of separating the leaders from the Jacobins as my measures were doing. I am indeed very discouraged, very embarrassed, very disappointed to have put myself forward so entirely alone."[2]

The reply of the Jacobins to the letter of Duquesnoy, to which Mirabeau referred, was a resolution of confidence in the Lameths and their friends in which they showed at the same time that they were aware of the attempts made to disunite them. "The

[1] Aulard, II, 152–54.
[2] Bacourt, III, letter of March 4.

Society of the Friends of the Constitution," they declared, "knows all the measures which are being employed to mislead public opinion and divide good citizens. It knows the libels with which the capital and the departments are inundated, and it was not surprised to rediscover the language of them in the letter signed 'Duquesnoy.' As the only answer it declares that the declamations of the intriguers are in its eyes honorable titles for the friends of liberty; that the letter it has just heard read adds to its esteem and attachment for M. Alexander Lameth and for those who, like him, have begun the revolution and have sustained it without vacillating. It declares that all attacks upon individuals will serve only to bind closer the ties by which they are united in all parts of the kingdom."[1]

This was the last triumph of the "Triumvirate."

It seems that Mirabeau and Montmorin intended to ask deputies of the center, such as D'André and Beaumetz, to return to the Jacobins, presumably to aid in overturning the leaders, but the Duquesnoy incident caused them to abandon this design.[2] Yet neither La Marck nor Montmorin shared Mirabeau's extreme discouragement, being convinced that the rule of the Jacobin leaders was near its end.[3] "Moreover," wrote La Marck, "these [the Jacobin leaders] no longer sustain themselves except by the use of cordials, and such remedies have never cured those in their death agonies."[4]

Events soon justified this belief. Barnave and the Lameths with their friends had begun to fear the results of their own excesses and the "cordials" they had used were to prove a factor in their undoing, for the suspicions and passions they had helped to arouse overpowered them when they wished to allay them. Below them a group of radicals had formed in the society, ready to attack them at the first sign of weakness or the first opportunity that offered success. The character of the men in the society in the spring of 1791 was not that of the spring of 1790.

[1] Aulard, II, 153–54.
[2] Bacourt, III, Montmorin to Mirabeau, March 3, 1791.
[3] *Ibid.*
[4] Bacourt, III 79, La Marck to Mirabeau.

The deputies were now greatly in the minority and ignorance had taken the place of enlightenment. The group of men who were to attack and displace the Jacobin leaders was largely composed of republicans, Brissot, Pétion, Robespierre, Robert, and a number of others who adhered to them. Camille Desmoulins, who was a special friend of Robespierre, belonged to the same group, but for a long time defended the Lameths because of their services to the revolution.[1] Of these, Brissot was the most dangerous opponent. He was the founder of the *Société des amis des noirs*,[2] and as editor of the *Patriote française* represented it in the press. To this society belonged such men as Mirabeau, Pétion, Condorcet, Sieyès, Lafayette, Abbé Grégoire, and Larochefoucauld. It was a combination of the *Amis des noirs* with the radicals and the right of the assembly which struck the decisive blow against the Jacobin leaders, enabled to do so through the long campaign of enlightenment waged by Brissot and the *Amis des noirs*. Brissot, whose enmity dated from the decree of March 8, 1790, relative to the colonies, allowed no opportunity of annoying them to pass.[3]

Through the agitation of the abolitionists and the principles announced in the declaration of the rights of man, grave troubles had arisen in the colonies between the planters, their slaves, and the free mulattos not possessed of political rights. It was a subject which called for delicate treatment by the National Assembly and which furnished its enemies a good occasion for embarrassing it. A great deal of hidden maneuvering seems to have been indulged in by both parties, the *Amis des noirs* and their supporters and the colonial deputies, the deputies of commerce, aided by a strong group in the Jacobin Club.[4] Mosneron de l'Aunay read a paper at the society on February 26, 1790, in which he strove to answer the *Amis des noirs* upon the question of the abolition of the slave trade by admitting that it was wrong

[1] *Patriote française*, No. 656, May 26, 1791.

[2] Founded in 1787, a kind of French abolition society.

[3] *Patriote française*, Nos. 515, 543, 545, 546, 553, 566, 582, 598, 609, and many others in 1790 and 1791. All those cited are in the first three months of 1791.

[4] The leaders of the Jacobins, especially Barnave and the Lameths.

from the standpoint of principle, but argued that expediency was the guide for statesmen, and that expediency in this instance called loudly for a continuation of the trade; for, were it to be abolished, France, through the intrigues of England, favored by the resulting disorders, would lose her colonies. He therefore asked the society to declare, among other things, that it did not intend to extend its decrees to the colonies, in order to reassure the colonists by allowing them the initiative in legislation.[1] Mirabeau answered De l'Aunay the same evening, opposing the slave trade, but with what success is not known, nor do we know what action, if any, was taken by the society.[2]

That slavery and the slave trade were inconsistent with the principles of the National Assembly announced in the declaration of the rights of man was immediately apparent to everyone, and was freely admitted by De l'Aunay, and it was the constant fear of the colonists and of those in France directly interested in the colonies that the assembly would prove consistent. But many deputies preferred being inconsistent to being the cause of immediate disaster to France. Tallyrand, as president of the assembly, replied to a deputation which had asked for a continuation of the slave trade, slavery, and the prohibitive régime in force with regard to the colonies, that the assembly would know how to "conciliate the rules of prudence and justice with the principles of liberty."[3] The subject came up in the assembly on March 2 when Grégoire, one of the most ardent *Amis des noirs,* read some papers from Martinique in his capacity as member of the com-

[1] Aulard, I, 9–17.

[2] This subject had long been agitated in the press, and many pamphlets and letters had been published upon it. De l'Aunay was a "député extraordinaire du commerce de Nantes," to the National Assembly, and he and his five colleagues applied to Le Roulx, deputy of Lorient, to present them to the Jacobins in order to read their address. Lorient being greatly interested commercially, Le Roulx readily gave his aid. This attempt was made toward the close of January, but for some unexplained reason, the reading of the address was postponed after permission had been received from the club. Even here "philanthropic ideas" were advanced against the granting of permission to read the address. Letter of Le Roulx January 23, 1790. MS. *Archives de Lorient.*

[3] *Correspondance de Bretagne* (of the deputies of Rennes), No. 1, February 25, 1790.

mittee on reports.[1] It was imperative for the opponents of the *Amis des noirs* that the subject of slavery and the slave trade should never be discussed in the assembly as an independent question, for in that case there could be but one issue, the *Amis des noirs* would have had the best of the argument, and all France would soon have learned that the assembly had either sacrificed the colonies and many home interests connected with them or that it had formally contradicted one of its own most fundamental principles. The right foresaw this dilemma and was eager to drive the assembly upon one or the other of its horns. Maury said triumphantly, "I shall force you to decree the freedom of the negroes; it is a necessary consequence of your principles. Commerce will be ruined, bankruptcy will follow, and you will all be lost."[2] The right of the assembly and the *Amis des noirs* thus found themselves fighting for the same object, namely, to bring about a thorough discussion of these questions. But they were in the minority and outmaneuvered at the same time. Alexander Lameth interrupted Grégoire in his reading and moved that the matter be referred to a special committee on colonies. In the debate which followed upon this motion his party was victorious. Lameth, Barnave, and a number of the colonial deputies, who of course favored the plan, were appointed on the committee.[3] On March 8, Barnave, as chairman of the committee, reported a plan which left the colonies under the existing régime until they themselves should undertake to change it, thus adopting the essential point in the proposition De l'Aunay had made at the Jacobins.[4] No sooner had he concluded than came reiterated calls of "question! question!" Mirabeau, Pétion, Grégoire, who rushed to the tribune, failed to obtain the floor; the discussion was "closed" before it had been opened, and Barnave's decree passed.[5] It was a typical Jacobin maneuver, later

[1] *Correspondance des députés du département d'Angers*, IV, 225–28, also *Correspondance de Bretagne*, supplement to no. III, 1790.

[2] Duquesnoy, *Journal*, II, bulletin of March 8, 1790.

[3] See *Correspondance des députés du départment d'Angers*, IV, 225–28. Also *Correspondance de Bretagne*, supplement to no. III, 1790.

[4] Barnave's report with his introductory speech is given in the *Correspondance des députés . . . d'Anjou*, IV, 263–64.

[5] *Bulletin de Brest*, volume for 1790, no. 29.

credited to Barnave alone, and one which his enemies never pardoned.

Barnave says in his *Mémoires* that his decrees upon the colonies gave him his popularity as well as robbed him of it.[1] With the more sane men, still dominant in the Jacobin Club, and at large his practical measures may well have won him support. Certain it is that he and the Lameths from this time on gained greatly in popularity and prominence and became the recognized leaders of the Jacobins from whom the formerly influential members were beginning to withdraw. A fresh discussion of the colonial difficulties found the Jacobin "Triumvirate" approaching the crisis of their career. If at the close of 1790 they had found it necessary to inaugurate a campaign of denunciation in order to sustain themselves, how much more was this necessary now when all appeals to moderation and prudence were regarded as evidence of perfidy or reaction. It was therefore extremely unfortunate for them that, at the very moment when they were attempting to retrace their steps, they should have been confronted with the necessity of defending a colonial policy which had now become unpopular. Thanks to Brissot, to Mirabeau, to the *Amis des noirs*, the affiliated societies and France generally had been enlightened upon the maneuvers that had resulted in the decree of March 8, and upon the inconsistencies of which the assembly had been guilty in passing it.[2] Some of the affiliated societies protested in addresses which Brissot printed with the intention of destroying his enemies.[3] Then the society on March 11 adopted an address to the affiliated societies urging moderation, Brissot attacked Barnave, who had drawn up the address, ridiculing his language and condemning the advice it

[1] *Oeuvres de Barnave, mises en ordre et précédées d'une notice historique sur Barnave par M. Berenger de la Drome* (Paris, 1843), II, 366.

[2] After the decree of March 8, a part of no. CCXLVII of the *Courrier de Provence* was devoted to enlightening its readers upon this subject and the manner in which it had been disposed of. The *Amis des noirs* even addressed some of their literature to the societies affiliated to the Jacobins (*Patriote française*, nos. 607, 617).

[3] See *Patriote française*, nos. 598, 602, 604.

contained as dangerous to the revolution.[1] Gorsas seconded Brissot and asked, "When will M. Barnave have done with these attempts to carry measures by storm?" referring to the manner in which the address was carried in the society and the decree of March 8 in the assembly.[2]

Despite the reassuring character of the decrees of the assembly the colonists had remained discontented, and Barnave and his supporters now urged that the declaration of non-interference be incorporated in the constitution in order that the status of the individual, the all-important question, might no longer be subject to regulation by mere legislative decree.[3] The debate, extremely violent, was carried on simultaneously in the National Assembly and the Jacobin Club. Brissot, aided by Pétion, on May 11 found the courage to attack Barnave in the club but sustained a defeat.[4] Two days later Robespierre and a certain mulatto continued the attack, this time with success.[5] Charles Lameth, who tried to defend his party, was driven from the tribune with shouts of hostility.[6] The next day they were defeated in the National Assembly also.[7] On May 29, the conservative committee on correspondence, of which Barnave and the two Lameths were the most prominent members, was changed.[8]

With the fall of the "Triumvirate," the Jacobin Club lost the only element which could still have directed it along moderate lines and preserved it from the excesses which were later to give

[1] Aulard, II, 189–92. Address given on pp. 185–89. Aulard does not assign any definite date to the address, but the *Feuille du jour*, no. 76, states that it was adopted on March 11.

[2] *Courrier de Paris*, XXII, no. 13.

[3] *Moniteur*, VII, no. 128.

[4] This fact is given in the *Lendemain*, May 13, 1791, and *Feuille du jour*, May 14, 1791, both opposition papers, but there seems no good reason for rejecting the evidence in this case, especially since both journals seem never to have invented the bare facts although they frequently distorted them. It should be added that from the similarity of their accounts it is clear that these two journals used a common source in nearly everything they published relative to the Jacobin meetings.

[5] Aulard, II, 412–15. Accounts taken from *Journal de la révolution*, May 15, 1791, and *Le Lendemain* of the same date.

[6] *Le Lendemain*, May 15, 1791.

[7] *Point du jour*, XXII, no. 673.

[8] *Courrier de Paris*, by Gorsas, XXIV, no. 31.

it such an odious reputation. Although no deputies at this time formally severed their connection with the society, few continued to attend its meetings. This was the moment of the real secession of the deputies, although the formal declaration of separation was not made until the 17th of July following.[1] There was no change of constitution, but the society from now on no longer remained true to its original aims, namely, to sustain and popularize the work of the National Assembly.

Of the character of the debates and the composition of the society about this time several witnesses have left us contemporary or almost contemporary accounts. The deputies of Maine et Loire, writing to the Friends of the Constitution of Angers, July 20, 1791, give such a vivid picture of conditions in the society that I quote them at length. "The undersigned, deputies of Maine et Loire," they wrote, "all founders or members of the Club of the Friends of the Constitution at the Jacobins of Paris, believed that it was their duty to separate themselves from it last Saturday with almost all their colleagues; [of the National Assembly] only four or five remained. They thought that it was no longer appropriate for them to remain in an association of which they were believed to have the direction and the majority, when that same association, formerly so useful for the destruction of tyranny and the reedification of a regular government based upon reason, has come to be guided by a crowd of foreigners who have obtained admittance, who have nothing to lose, and of whom the major portion is paid by these same foreigners who desire absolutely to cause our revolution to fail like that of Brabant. From that time, this assembly presented only the image of an assembly of furies who believed they could be useful to the country only in preaching disorder and anarchy and in degrading all authority by causing the people to destroy them and who not only for six weeks or two months suffered the expression of but one opinion, reasonable or not unless it were incendiary, but even drove out with violence members who expressed an opinion contrary to the one our most cruel enemies could most desire because it evidently led us to civil war. Never-

[1]Aulard, III, 30.

theless, we do not pretend that the club is composed entirely of men such as we have described; indeed, a very large portion of the members not deputies to the National Assembly have withdrawn from the club, and among those who show themselves the most fanatic there are unquestionably many honest and estimable citizens who, not having studied mankind sufficiently and estimated the elements which ought to compose a government, although these elements are everywhere the same, because reason is indivisible, ought nevertheless to be differently combined according to the country, the population, the customs, language, civilization, wealth, commerce, etc., and, allowing themselves to be drawn on by a just indignation, think only of a vengeance which is without doubt very legitimate, but not thinking that long years of frightful misfortunes and the loss of liberty will be the necessary consequences of their action. These persons, misled by detestable men who profit by the inconsiderate ardor of noble and generous souls, make of them the instruments of their ambitious projects and seek by their aid to open the door to the most unbridled factions."[1]

One might suspect from the tone of this letter that the writers exaggerated the faults of the society in order to better justify their own action in withdrawing from it, but, unfortunately, their testimony is only too well borne out by that of the intelligent Prussian, Conrad Oelsner, who was a member of the club and reasonably free from partisanship.[2] Most convincing, however, is the official record of the club itself giving the outline of the debates beginning with June 1, 1791.[3] In reading this, one is tempted to believe the accounts of their meetings given in the

[1] *Journal du département de Maine et Loire*, published by the *Amis de la constitution* of Angers. Bib. Nat. Lc. $^{0}/_{229}$.

[2] Luzifer oder Gereinigte Beiträge zur Geschichte der französischen Revolution. Erster Theil (1797), 160. Among other things he wrote in the spring of 1791: Es hat sich eine Menge rollelustiger Glücksritter und Ehrgeiziger angedrängt, die, um zu Kredit zu gelangen, einen schreienden Patriotismus affichirt und zu jedem ausschweifenden Projeckte die Hand bietet. Tumult und Bitterkeiten ersticken die Stimme der aufgeklärten Mässigung, und haben viele scharfsehende, aber furchtsame oder zu unrechten Zeit empfindliche Leute verscheucht, etc.

[3] *Journal des débats de la société des amis de la constitution, séant aux Jacobins, à Paris.* Republished by Aulard, II.

hostile journals, *Le Lendemain* and *Le Feuille du jour*, often the only record we possess before the official journal just mentioned was published.

The Jacobin leaders were driven from the club because they were no longer in sympathy with it. They had been true, in outward form at least, to the published principles of the society, whereas the radicals who had succeeded them in the favor of its members had come to regard the assembly as reactionary and not to be trusted. But it was not until the flight of the king that the society assumed an attitude that forced the deputies to withdraw from it in order not to appear in a false light. The constitution was monarchical and almost all the deputies were monarchists. The Jacobins also were avowed monarchists, although they had long ceased to show monarchical sentiments in their discussions. Many had expressed their bitterness against the ministers and all the other servants of the king, but either through policy or an irrational sentiment excused the king himself. The king was eternally the dupe of his counsellors. The flight of the king to Varennes was more, however, than most of the Jacobins were able to excuse upon this theory, and the question as to what should be done with the king was openly brought to discussion.

But the deputies who had informally withdrawn made one more effort to regain control of the society, making the flight of the king the occasion for the attempt. This attempt was foreseen by the man, perhaps, most interested, Robespierre, who successfully defeated it. The Jacobins had met at noon on the 21st of June, 1791, in extraordinary session, with all excitement studiously suppressed, as it was in the whole of Paris. For once the agitators now in possession intended to aid in preventing disturbances, and sent out some of its members to preach peace and calm in the public places.[1] The entrance of Robespierre, fresh from the National Assembly, changed the entire tone of the meeting, which now became intensely dramatic. Robespierre represented France as in the greatest danger, not because the king had fled to return at the head of a foreign army, but be-

[1] Aulard, II, 532.

cause of the friends he had left behind, many of whom it was impossible to distinguish from the patriots. "What frightens me most," he exclaimed, "is that which seems to reassure everyone else. . . . It is that this morning all our enemies speak the same language as ourselves. All are reunited, all wear the same countenance." The minority long since and the entire National Assembly with its committees had shown by its action that morning that it was in the plot with the king for the destruction of liberty. "And as if this coalition were not enough, I know that presently it will be proposed that you unite with all your most notorious enemies; in a moment, all of '89, the mayor, the general, the ministers, it is said, will arrive! How can we escape?" He concluded by saying that he knew that in the denunciations he had just made he had drawn a thousand assassins upon himself, but he would receive death almost as a blessing because it would spare him the sight of the evils he saw were inevitable. Upon this, the eight hundred or more members present arose and swore that they would sacrifice their lives in protecting him.[1]

As Robespierre concluded, the arrival of the deputies was announced, whereupon Danton sprang to his feet and exclaimed: "Gentlemen, if the traitors present themselves here I take the formal engagement with you to leave my head upon the scaffold or prove that theirs ought to fall at the feet of the nation they have betrayed." Seeing Lafayette among those who had entered, he violently apostrophised him, going over the entire list of grievances the radical members of the club had long held against him. "And you, M. Lafayette, who only recently responded for the person of the king with your head, do you pay your debt in appearing in this assembly? You have sworn that the king would not depart. Either you have betrayed your country or you are stupid in having answered for a person for whom you could not answer. In the more favorable case, you are declared incapable of commanding us. . . . France can be free without you. Your power weighs upon the eighty-four departments. Your reputation has passed from pole to pole. Do

[1] *Révolutions de France et de Brabant*, no. 82. Aulard, II, 553.

you wish to be really great? Become a simple citizen again, and no longer nourish the just distrust of a large portion of the people."[1]

A strange spectacle followed this attack of Danton. Alexander Lameth, whose thundering anathema had on the 28th of February preceding fallen on Mirabeau and Lafayette alike, now stepped forward in the latter's defense. "I have always regarded M. Lafayette as one of the firmest supports of the constitution," he said, "and although I have often blamed his conduct and under some circumstances spoken of him perhaps with bitterness, I have told M. Danton himself that if the constitution were in danger Lafayette would die for it sword in hand. . . . It is necessary to abjure all hate, cause every division to cease, in order to disconcert all the maneuvers of the enemies of liberty and march with a sure and firm step to the completion of the constitution."[2]

After Lameth, the proud Lafayette, whom neither prayers nor denunciations had moved to return to the Jacobins, humiliated himself in attempting a defense before those whom he despised. He spoke but a few very unsatisfactory words. Sieyès was more successful in explaining away a certain address of his, very obnoxious to the Jacobins, and Barnave succeeded in another "Triomphe d'assaut" in causing an address to the affiliated societies, drawn up by himself, to be adopted, in which it was said that "All divisions are forgotten, all patriots are reunited. The National Assembly is our guide, the constitution our rallying cry."[3]

This address, the official attitude of the club only in form, must not be allowed to mislead us. The debates in the club show us that this attempted reunion was a complete failure. The deputies, if they ever returned in any considerable number, remained silent and without influence.[4] Lafayette, whose answer

[1] *Révolutions de France et de Brabant*, no. 82. Aulard, II, 553.

[2] *Ibid.*, II, 536.

[3] Aulard, II, 538.

[4] See the debates during the latter part of June and the beginning of July as given in the official journal republished by Aulard, II. A few of the

to Danton was considered very unsatisfactory, refused the invitation to come to the club and make another.[1] The society continued its tumultuous sessions as before, inclining more and more to the view that the king had forfeited his right to the throne—that is, taking a position more and more in opposition to the National Assembly—until, on the 17th of July, 1791, the deputies who were still nominally members of it formally withdrew and formed the new society of the Feuillants.

more radical deputies had always remained with the club, and on June 29 Charles Lameth is mentioned in the debates as objecting to some remarks of Anthoine against certain persons whom he did not name, but received little applause and a great many "*murmures*" ("*murmures excessifs*").

[1] Aulard, II, 547.

## III.—*On the Substantivation of Adjectives in Chaucer*

BY ARTHUR GARFIELD KENNEDY

### INTRODUCTION

The substantivation of adjectives in English has, like most other processes of our language, been so gradual that it is difficult to fix the beginning of it in the case of any particular word or group of words, or at any one time to measure accurately its progress. Perhaps the most satisfactory results are obtained by comparing the data made up from the writings of authors of different periods. This investigation is offered as a study of the process of substantivation of adjectives in the fourteenth century, as shown in the writings of Chaucer.

Kellner[1] names three ways in which adjectives become substantivized: first, the quality of a thing is so striking that the name of the adjective is adopted for the substantive itself. So *gold* was originally 'the yellow metal,' *wheat,* the 'white grain,' etc. Secondly, ellipsis may bring about this process of substantivation. Since the adjective conveys the idea of the noun to which it is attached, the noun is dropped. So we have *the Almighty, a saint, a sage, the good,* etc. Finally, adjectives are used as substantives when they denote abstract ideas, as *good, evil, ill,* etc.

Adjectives may be used in different degrees of substantivation. One usage which was quite common a few centuries ago was that in which the adjective modifies a preceding noun. When Chaucer says, "A true swynk and a good was he," we feel that *good* is, at least partially, a substantive. Again, the use of the

[1] *Outlines of English Syntax,* pp. 144–50.

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adjective with *one* has gradually become more common. To say "the bravest one I ever knew" is quite in keeping with modern usage. The most complete substantivation, however, requires no other word for the adjective to lean upon. Thus we say, the *good,* the *true,* the *beautiful,* the unknown *dead,* for 'goodness,' 'truth,' 'principle of beauty,' etc.

It is not the purpose of this paper to enter into a discussion of the causes and beginnings of this process of substantivation. The most probable cause seems to be that of the force which Professor Paul[1] calls "economy of expression." It would seem the most natural thing to abbreviate *the noble people* to *the noble,* or the Old English *se betsta guma* to *se betsta,* especially if the expression is so common that no one would misunderstand it. This seems especially probable when we note that most of the substantivized adjectives in the *Beowulf* and the earlier English literature are personal substantives.

## SUBSTANTIVATION OF ADJECTIVES IN OLD ENGLISH

Many words which are nouns, pure and simple, in Chaucer's day, have been developed from earlier adjectives or participles. As examples we have *strete,* from Latin *strata via; mile,* from Latin *milia passuum; frend,* for Gothic *frijonds; side,* for Old English *sid; wheat* and *gold* have been mentioned; and many others might be cited.

In the *Beowulf* we find the prevailing usage,—the adjective for the person described:

> Häfde se *goda* . . . cempan gecorone, l. 205. Cf. also 355, 676, 1191, etc.—Gewat him þa se *hearda,* l. 1964. *hares* hyrste Higelace bär, l. 2988.—on þäm se *rica* bäd, l. 310.—Näfre ic *maran* geseah eorla ofer eorðan, ll. 247–48.—cwäeð þät se *almightiga* eorðan worhte, l. 92.—þät he on eorða geseah þone *leofestan* lifes ät ende, l. 2834.

Gradually, after the Anglo-Saxon period, we find a broadening in the use of substantivized adjectives. Many examples ap-

[1] *Principien der Sprachgeschichte,* p. 263.

pear in Chaucer of words of French origin which seem to have been used substantively for a long time. As examples Einenkel[1] gives the following:

> *laxatyf, equnoxial, digestives, necessaries, moeubles, contraries,* the *suffrant,* his *pacient,* this *innocent, penetentys, nobles,* etc.

## II. SUBSTANTIVATION OF ADJECTIVES IN CHAUCER

For a proper appreciation of the substantivation of adjectives in Chaucer we must consider examples of all three usages, namely, qualifying a preceding noun, with *one,* and without *one,* as a pure substantive. Then a comparison can be made with reference to the relative importance of the three in Chaucer's time. Also it might be of interest and profitable to compare the use of positives, comparatives, and superlatives in this respect. The syntactical relations of substantivized adjectives seem to demand consideration. In what constructions do we find them prevailing? Do they appear in any special constructions in Chaucer? Finally, and of some importance it seems to me, are the questions and theories relating to the beginnings of this process of substantivation. Is it a native tendency or does it come into the language through some foreign influence? Are the adjectives so substantivized largely native words or foreign? Perhaps a careful comparison of the two elements will throw a little light on the subject of the origin of adjective substantivation.

Einenkel makes a distinction, which might well be kept in mind all through the consideration of this subject, between adjectives previously, and hence thoroughly, substantivized, and those which are substantivized merely for the occasion. For instance, we think of *nobles* as a pure noun but the *wise* as a temporary substantive only. This distinction will be touched upon again, however.

[1] *Streifzüge durch die Mittelenglische Syntax.*

A. Semi-substantivized adjectives referring to preceding nouns.

This use of the adjective is quite common in Chaucer. No attempt will be made to cover the field entirely, but simply to give illustrations which seem most characteristic.

> A theef he was, forsoth, of corn and mele, And that a *sleigh*. Reeves Tale, 20.—A true swynk and a *good* was he. Cant. Tales: Prologue, 531.—of Gamelyn the *bolde*. Tale of Gamelyn, 290.—of Gamelyn the *yonge*. *ibid.*, 342.—At the root of Vesulus the *colde*. Clerkes Tale, 2.—this January the *olde*. Marchaundes Tale, 798.—For sche was on the *fairest* under sonne. Frankeleynes Tale, 6.—Ther was a monk, a fair man and a *bold*. Schipmannes Tale, 25.—but a governour, a *wily* and a *wyse*. Prologue of Monkes Tale, 52.—this Seneca the *wyse*. Monkes Tale, 525.—To Cupido the *recheles*. Hous of Fame, Bk. II. 160.—Gaweyn the *worthy*. Romaunt of the Rose, 2209.

B. Substantivized adjectives used with *one*.

This use of the adjective is very limited in Chaucer. And not only are there few examples of it, but there is not much variety in the adjectives so used. Varying forms of our modern *such* appear most common.

> That han *swich oon* icaught withouten net. Troylus and Cryseyde, Bk. II. 583.—To slane *swice oon*. *ibid.* Bk. II. 265.—I am *oon* the *fayreste*. *ibid.* Bk. II. 746.—with *swich oon* as he is. ibid, Bk. V, 740.—For I have falsed *oon* the *gentileste* and *oon* the worthyeste. ibid, Bk. V. 1050.—that betrisshed *many oon*. Romaunt of the Rose, 1648.—Thou herdest never *sich oon*, I trow. *ibid.* 5409.—Ymaginynge that travaille nor game Ne myghte for so *goodely one* be lorne. Troylus and Cryseyde, Bk. I. 372.—As help me God I was a *lusty one*. Prologue of Wyf of Bathe. 605.

Einenkel[1] gives the last two examples and adds, "Dies sind die beiden einzigen Fälle wo ich das Zahlwort beim positiven Adjectiv entdecken konnte. Sein eigentlicher Platz ist beim Superlativ." Illustrative of the latter statement he gives the following:

[1] *Streifzüge durch die Mittelenglische Syntax*, p. 27.

A maide *oon* of this worlde the *best preysed.* Troylus and Cryseyde, Bk. V. 1474.—Of hire delite or joies *oon* the *leste. ibid.* Bk. III. 1261.—For sche was *on* the *fairest* under sonne. Frankeleynes Tale, 6.

Examples might also be given of the use of adjectives with other weakened substantives such as *man, woman, thing,* etc. Often with these words, just as with *one,* the adjective becomes slightly substantivized. In the case of most of these, however, the substantivation is not far enough advanced to make them worthy of special comment.

C. Substantivized adjectives used without *one.*

Adjectives substantivized without the aid of *one* are very common in Chaucer. Of course there are varying degrees of substantivation. Sometimes we feel that the adjective force of the word has largely been lost sight of, as in *nobles, gentils,* or *goode* (meaning property), *at last* (used adverbially), *elders,* etc. At other times the word is little more than an adjective, even though it stands in the place of a noun.

1. As personal substantives in singular and plural (without *-s*). This use of the adjective is very common. In a comparatively thorough examination of Chaucer I have noted 137 examples, including 66 different forms.

Of the plural personal substantives the following are good examples:

to visit the *ferrest* in his parrische. Cant. Tales Prologue, 493.—We will slee the *gultyf.* Cokes Tale of Gamelyn, 822.—Herkneth what is the sentens of the *wyse.* Man of Lawes Tale, 15.—Faire they were welcomed, bothe *leste* and *meste.* Cokes Tale of Gamelyn, 460.—That at the fest leet slee bothe *more* and *lesse.* Man of Lawes Tale, 861.—And further goeth all the contre bothe *moste* and *leste.* Court of Love, 1431.—Sche was not with the *leste* of hire stature. Troylus and Cryseyde, Bk. I. 281.—he commendeth with the *beste.* Man of Lawes Tale, 76.—and bothe of *yonge* and *olde* Ful wel beloved. Troylus and Cryseyde, Bk. I. 129.—"Trentals" sayd he, "delyvereth from penance Her frendes soules as *wel eld* as *yonge.*" Sompnoures Tale, 16.—Therfore

she stood in love and grace Of *riche* and *poore* in every place. Romaunt of the Rose, 1169–70.—Born of the *gentilest* and the *heighest* of this land. Clerkes Tale, 75.—he wil not visite the *sike*. Persones Tale.—And ponysche . . . the false *untrew* Court of Love, 582.—she pleyeth with *fre* and *bonde*. Troylus and Cryseyde, Bk. I. 840.—*Lered* or *lewde* lord or lady. Romaunt of the Rose, 6620.—Whereso thou comest, amonges *heih* or *lowe*. Maunciples Tale, 257.—alle the *grettest* that were of that land. Tale of the Pardoner, 145.—Men seyn the *suffrant* overcomth, parde. Troylus and Cryseyde, Bk. IV. 1556.—For he nought helpeth the *needful* in his need. Man of Lawes Tale, 14.

So also we find *gulteles, all wofulle, the meekest, the unworthieste,* etc.

Of the use of the adjective as a singular personal substantive we find many examples.

I not which was the *fairer* of hem two. Cant. Tales: Prologue, 190.—*Feirest* of alle that ever were or be! Court of Love, 631.—*Best* unto *best. ibid.* 594.—So stant this *innocent* before the king. Man of Lawes Tale, 520.—I have a wyf, the *worste* that may be. Prologe of Marchaundes Tale, 6.—The foul royal above yow in degree The *wyse* and *worthy*. . . . Assembly of Foules, 395.—This *yongest* which that went to the toun. Tale of the Pardoner, 375.— . . . the *Romayn*, Galien Ne dorste never been so corageous, Ne noon *Ermyn*, ne noon *Arabien*, Ne *Surrien*, ne *noon Egipcien*. Monkes Tale, 348.—But if for love of som *Troyan* it were. Troylus and Cryseyde, Bk. V. 877.—though that be true, my *dere*. Court of Love, 173.—That every yere wolde have a *newe*. Hous of Fame, 302.—and she was holden there A *seint*. Legende of Lucrecie, 192.—the *worthieste* of knyghthode . . . of blode the *gentyleste*. Assembly of Foules, 548.—ye lovers, for the *konnyngeste* of yow. . . . Troylus and Cryseyde, Bk. V. 331.—a *coveytous* and a *wriche*. *ibid.* Bk. II. 1324.—Tellynge his tale alway, this olde *greye*. *ibid.* Bk. IV. 99.—Now writeth, *swete*. *ibid.* Bk. V. 1399.—The *formest* was alway behynde. Boke of the Duchesse, 889.—*Humblest* of herte, *higheste* of reverence. Compleynte Unto Pite, 57.—Now faire *blisfulle*, O Cipris. Troylus and Cryseyde. Bk. II. 10.—But nothing thinketh the *fals* as doth the *trewe*. Anelyda and Arcite, 168.—In love a *falser* herde I never none. Legende of Phillis, 5.—The *stronge* the *feble* overgoth. Romaunt of the Rose, 6823.—He kepte his *pacient* wondurly wel. Cant.

Tales: Prologue, 415.—The neye *slye* maketh the ferre *leef* to be loth. Milleres Tale, 206.—Ne never saugh I a *more bountevous* . . . ne a *more graciouse*. Troylus and Cryseyde, Bk. I. 883.—And therto I saugh never a *less Harmful* than she was in doinge. Boke of the Duchesse, 993.—Emelye, the *rewfullest* of al the companye. Knyghtes Tale, 2028.

2. As personal substantives in plural (with *-s*). As we would naturally expect, the use of adjectives in this way is very much limited. For an adjective must be pretty thoroughly substantivized before we can feel free to decline it in the plural, as we do other nouns. The best examples, and in fact almost the only ones, are the following:

As custom is unto these *nobles* alle. Marchaundes Tale, 645.—And he forth the *seyntes* ladde. Secounde Nonnes Tale, 369.—There *saintes* have here comyng. Court of Love, 120.—right anoon the *gentils* gan to crie. Prologue of the Pardoner, 37.—Of honoures that oure *eldres* with us lefte. Monkes Tale, 208.—By God and by his *halwes* twelve. Boke of the Duchesse, 830.—To *innocents* doth such grevance. Romaunt of the Rose, 4273.—And the *seculars* comprehende. *ibid.*, 7175.—Brynge us to that paleyce that ys bilte To *penytentys*. Chauceres ABC:Z.—And after hem of *comunes* after here degre. Knyghtes Tale, 1715.

3. As abstract nouns in singular. The class of adjectives used by Chaucer as abstract nouns is by far the largest of all. While it is, perhaps, hardly necessary to give examples of all, out of the sixty different adjectives which I have noted under this head, we may consider a few of the most typical. One very important division of this class is made up of color adjectives. Of these *green* is used most frequently.

And Emelye, clothed al in *grene*. Knightes Tale, 827.—Twenty bokes clad in *blak* and *reed*. Cant. Tales: Prologue, 294.—of fyn scarlett *reed*. *ibid.* 457.—A long surcote of *blue*. *ibid.* 611.—A marchant was ther . . . in *motteleye*. *ibid.* 271.—They gloweden betwixe *yolw* and *reed*. *ibid.* 1274.—With face deed, betwyxe *pale* and *grene*. Anelyda and Arcite, 356.

Of all the abstract adjective substantives *good* is used most commonly:

and doon us som *good*. Cokes Tale of Gamelyn, 664.—And ches the *best* and lef the *worst* for me. Knyghtes Tale, 756.—And bad him doon his *best*. Cokes Tale of Gamelyn, 238.—That yeveth hem ful ofte in many a gyse Wel *bettre than* they can hemself devyse. Knyghtes Tale, 1253.—I recche naught what *wrong* that thou me profre. Secounde Nonnes Tale, 489.—He thar nat weene that *evyl* doth. Reeves Tale, 400.—Who hath the *worse* . . . ? Cant. Tales: Prologue, 490.—By alle *right* it may do me no shame! Troylus and Cryseyde. Bk. II. 763.—And al his *ernest* turneth to a jape. Milleres Tale, 204.

This last is one of Chaucer's favorite expressions. The combinations, *ernest* and *jape*, or *ernest* and *game* occur very often.

Nature, the vyker of thalmyghty Lorde, That *hoot, colde, hevy, lyght, moist* and *drye* Hath knyt. Assembly of Foules, 397.—but of myn oughne *sore* . . . I telle may no more. Prologue of Marchaundes Tale, 31.—for *foule* ne *faire*. Man of Lawes Tale, 426.—Leving the *streight*, holding the *large*.—Other combinations are· *good* or *ille; softe* ne *sore; schort* and *plain; heigh* or *lowe; colde* or *hote*.
He had a jape of malice in the *derk*. Cokes Prologue, 14.—For unto him it is a bitter *swete*. Prologue of the Chanonnes Yeman, 325.—Your *bitter* tornen into swettenesse. Troylus and Cryseyde Bk. III. 130.—Or Cecile is to saye, the waye of *blynde*. Secounde Nonnes Tale, 92.—As shulde a maister of *dyvyne*. Romaunt of the Rose, 6490.—Her heed for *hore* was whyte as floure. *ibid.* 356.

Other examples of this usage are: the *contrary*, a *litel, grete* (for greatness), *mene, newe*, the *revers, faire, untrewe, quiete, veyne, unright, remenaunt, wery* (for weariness), *large, harde* (for hardship).

We find quite frequently the proper adjective used as the name of a language.

Naught wist he what his *Latyn* was to saye, Prioresses Tale, 71.—And for ther is so grete dyversite In *Englissche*, and in writynge of our tonge. Troylus and Cryseyde. Bk. V. 1807.

A large number of adjectives are found as objects of prepositional phrases and are so plainly adverbial as to require special treatment. No doubt they were at first abstract nouns, but the adjective force seems very largely to have disappeared even in Chaucer's time. For examples of such usage see II. E. 5.

4. As abstract nouns, in plural (with *-s*). As in the case of personal substantives with *-s*, we find that examples are not so common. Only a limited number of abstract adjective substantives seem to have arrived at that stage where they could be pluralized as nouns.

> By certeyn *means*. Man of Lawes Tale, 382.—or ye have your *rightes*. Marchaundes Tale, 418.—But thilke *wronges* may I not endure. Secounde Nonnes Tale, 491.—schewynge me the perils and the *evils*. Tale of Melibeus.—the grete *goodes* that comen of pees. *ibid.*

5. As neuter concrete nouns. Adjective substantives used as neuter concrete nouns are found very frequently in Chaucer. Of these only ten, however, are used in the plural.

> Whanne wille and *goodes* ben in comune. Romaunt of the Rose, 5209.—And *deyntes* mo than I can of devyse. Man of Lawes Tale, 321.—The somme of fourty pound anoon of *nobles* fette. Chanounnes Yemannes Tale, 353.—Sith thus of two *contraries* is a lore. Troylus and Cryseyde. Bk. I. 645.—the rentes and *rightes*. Persones Tale.—feldes and *playnes*. Hous of Fame, 389.—Such maner *necessaries* as ben plesynges. Man of Lawes Tale, 613.—A day or tue ye schul have *digestives* Of wormes, er ye take your *laxatives*. Nonne Prestes Tale, 141.—And him she yaf her *moeubles* and her thing. Tale of Melibeus.

Of examples in the singular we may easily make two classes, namely, those which are so thoroughly substantivized as to have a nominal function without the context, and those which depend upon the context for their substantive value. It is, of course, only from nouns of the former class that plurals are made. Most common of this class is the word *good* (meaning 'property').

> to yive a penny of hir *good*. Freres Tale, 277.—Than in the Tour the *noble* iforged newe. Milleres Tale, 10.—That day that I shall drenchen in the *deepe*. Man of Lawes Tale, 357.—Thay doon a grete *contrarie*. Romaunt of the Rose, 4478.—Thou darst nat standen by thy wyves *right!* Monkes Prologue, 24.—the dyche over the *pleyne*. Romaunt of the Rose, 4202.—And woneden so neigh upon a *grene*.. Legende of Thisbe, 7.—For Goddes sake as take som *laxatuf*. Nonne Prestes Tale, 123.—By nature knew he each ascensioun of *equinoxial*. in thilke toun. *ibid.* 35.

Of the following the substantivation depends upon the context:

> Which that hath the *schortest* schal begynne. Cant. Tales: Prologue, 836.—And cowde a *certeyn* of conclusiouns. Milleres Tale, 7.—of stedes in my stalle Go chese thee the *best*. Cokes Tale of Gamelyn, 180.—For trusteth wel it is an *impossible* That any clerk schal speke. Prologue of the Wyf of Bathe, 688.—al the *revers* seyn of his sentence. Nonne Prestes Tale, 157.—Of alle happes the *alderbest*, The *gladdest* and the moste at reste. Boke of the Duchesse, 1278.—And if the *next* thou wolt forsake. Romaunt of the Rose, 2822.—Peyne the not eche *crooked* to redresse. Good Counseil of Chaucer, 8.

In addition to the above examples, the following also occur: *worst, lesse,* many *smale* maketh a *gret,* with the *first* and with the *best,* the *remenant.*

6. Numeral adjectives as substantives. The use of the numeral as a substantive is very common in Chaucer.

(*a*) Numerals used as personal substantives.

> to that *on* as well as to that *other*. Cokes Tale of Gamelyn, 39.—(Chaucer's use of these two words would indicate that even in the XIV century very little of their numerical value remained.) Adam felde *tweyne* and Gamelyn felde *thre*. *ibid.* 593.—a *thousand million* rejoising love. Court of Love, 589.—*ôn* of the *tweye*. Troylus and Cryseyde. Bk. I. 493.

(*b*) Numerals used adverbially.

> they dalten it in *two*. Cokes Tale of Gamelyn, 45.—and then at *erste*. Troylus and Cryseyde. Bk. IV. 1293.—and parted hem in *foure* anoon. Romaunt of the Rose, 7749.—As though your herte anoon in *two* wolde breste. Praise of Women, 58.

(*c*) Numerals referring to time.

> Er it be fully *prime* of day. Tale of Sir Thopas, 114.

7. Pronominal adjectives as substantives.

> Mystruste *alle* or elles *alle* leve. Troylus and Cryseyde. Bk. III. 688.—And he that mover is of *alle*. Hous of Fame. Bk. I. 81.—*Fewe* was ther that night that slept. Swich an *other* for to make. Hous of Fame. Bk. III. 81.

Many illustrations of the use of *oon* and *other* as pronouns can be found.

D. Substantivation of superlatives and comparatives.

In addition to the use of adjectives in the positive degree many comparatives and superlatives are found to be substantivized by Chaucer.

1. Comparatives.

> Ne never saugh I a *more bountevous* Of hyre estate ne *gladder* nor of speche A *frendlyer*. Troylus and Cryseyde. Bk. I. 883.—Of harmes the *lesse* is for to chese. *ibid.* Bk. II. 470.—In love a *falser* herde I never none. Phillis, 5.—Of honours that oure *eldres* with us lefte. Monkes Tale, 208.—That at the fest leet slee both *more* and *lesse*. Man of Lawes Tale, 861.

2. Superlatives.

> to the *lest* and to the *meste*. Squyeres Tale, 292.—*best* unto *best*. Court of Love, 594.—Emelye, the *rewfullest* of alle the companye. Knyghtes Tale, 2026.—He that semeth the *wisest*, by Jesus, Is most fool. Born of the *gentilest* and the *heighest* Of al this land. Clerkes Tale, 75.—I am oon the *faireste*. Troylus and Cryseyde. Bk. II. 746.

It is to be noted that the use of comparatives and superlatives with *one*, a very common usage in modern English, is seldom seen in Chaucer. Probably not more than a half dozen examples are to be found. Of special interest in this connection is the following statement by Dr. Louise Pound,[1] "Examples of the substantivation of comparatives and superlatives as personal substantives through *one* are not frequent even in the last half of the sixteenth century, when it was very common with the positive. Dr. Gerber, investigating fifteenth and sixteenth century English, finds but one example."

[1] *Comparison of Adjectives in English in the XV. and the XVI. Century*, p. 64.

## E. The Syntax of substantivized adjectives.

Chaucer uses his adjective substantives, as a general rule, just about as he uses other nouns. Certain peculiarities of usage we may note specially.

1. General uses:

(*a*) As subject of a verb.

> Now *foule* falle hire for thi wo and care. Troylus and Cryseyde. Bk. IV. 434.—*good* and wikkednesse ben two contraries. Tale of Melibeus.—The *stronge* the feble overgoth. Romaunt of the Rose, 6823.

Adjectives thus substantivized are used very often in apposition to the subject.

> Faire they were welcomed, bothe *leste* and *meste*. Cokes Tale of Gamelyn, 460.—Ful besily they wayten, *yonge* and *olde*. Squyeres Tale, 80.

(*b*) As the object of a verb.

> A! wolde ye nowe repent and love some *newe?* Court of Love, 462.—and sauf your feithful *trewe*. *ibid.* 993.—That any clerk schal speke *good* of wyves. Prologue of Wyf of Bathe, 689.—So that ye offren *nobles* or starlings. Prologue of Pardoner, 445.

(*c*) As the predicate noun.

> he is the *worthyeste*. Troylus and Cryseyde. Bk. II. 739.—For trusteth wel, it is an *impossible*. Prologue of Wyf of Bathe, 688.

(*d*) Traces of the old partitive genitive are shown still in a few expressions:

> I am a sede foule, oon the *unworthieste*. Assembly of Foules, 512.—And yet was he, wher-so men went or riden Found oon the *fairest* under sonne. Troylus and Cryseyde. Bk. I. 493.—For sche was oon the *fairest* under sonne. Frankeleynes Tale, 6.—I have the most stedefast wyf And eek the *meekest* oon that bereth lyf. Marchaundes Tale, 307.—I am oon the *faireste* out of drede. Troylus and Cryseyde. Bk. II. 746.

(*e*) As the object of a preposition:

To make him lyve by his propre *good*. Cant. Tales: Prologue, 581.—As custom is unto these *nobles* alle. Marchaundes Tale, 645.—Uproos the oon of these olde *wise*. Tale of Melibeus. Born of the *gentilest* and the *heighest* of this land. Clerkes Tale, 75.—By certeyn *menes*. Man of Lawes Tale, 382.—That day that I shall drenchen in the *deepe*. Prologue of Wyf of Bathe, 314.

2. Use in the vocative and in exclamations.

Have mercy on me, *swete*, or ye wolen do me deye. Frankeleynes Tale, 250.—Com doun my *leef*, and if I have myssayde. Marchandes Tale, 1145.—Farwel, my *swete!* farwel my Emelye. Knyghtes Tale, 1922.—Now faire *blisfulle*, O Cipris. Hous of Fame. Bk. II. 10.—myn owne *deere*. Romaunt of the Rose, 4377.—*Humblest* of herte, *higheste* of reverence. Compleynte of Dethe of Pite, 57.—O seely prest O sely *innocent*. Court of Love, 631.—*Feirest* of alle that ever were or do! Court of Love, 631.

3. Use with adjective and adverb modifiers. The general statement made at the beginning of this discussion of syntax applies here. Adjectives substantivized may be modified by other adjectives just as nouns are. So we find in Chaucer:

the neye *slye* Maketh the ferre *leef* to be loth. Milleres Tale, 206.—That goode *leef* my wyf. Prologue of Monkes Tale, 6.—And I to ben youre veray humble *trewe*. Troylus and Cryseyde. Bk. III. 92.—the proverbe saith that many *smale* maketh a *grete*. Persones Tale.—And chyde her the holy *innocent* your wyfe. Sompnoures Tale, 275.—And to the doctrine of these olde *wyse*. Prologue of Legende of Goode Women, 19.—For unto hem it is a bitter *swete*. Prologue of Chanounnes Yeman, 325.—And saugh the soruful *ernest* of the knyght. Troylus and Cryseyde Bk. II. 453.

4. Those adjectives which are not so completely substantivized as to have lost altogether their adjective nature may be modified by adverbs:

(*a*) In the positive degree:

> The sonne saugh nevere yet . . . so inly *faire,* so *goodly* as is she. Troylus and Cryseyde. Bk. III. 1555.—That yeveth him ful ofte wel *better* than thei can hemself devyse. Knyghtes Tale, 395.—And seyst thou hast to *litel* and he hath al. Man of Lawes Tale, II.

In the case of *verray right* (Romaunt of the Rose, 1627) *verray* seems to be in that transitional state where it is either adjective or adverb.

(*b*) In the comparative degree:

> Ne never saugh I a more *bountevous* ne a more *graciouse.* Troylus and Cryseyde. Bk. I. 883.—And therto I saugh never yet a less *Harmful* than she was in doynge. Boke of the Duchesse, 993.

5. Use with the article.

(*a*) The indefinite article.

Of the use of the indefinite article with substantivized adjectives, Maetzner[1] says: "The transmutation of an adjective into an uninflective substantive, as a name of a person, is not favored in Modern English, in connection with the indefinite articles. Adjectives and participles, otherwise capable of being used substantively with the definite article, support themselves when referred to an indeterminate individual by the pronominal *one,* which is to be regarded as the substantive bearer of the adjective. 'There cometh one mightier than I after me' (Mark I, 7)." This shows us modern conditions as Maetzner found them and also gives us his opinion concerning the degree of substantivation of adjectives when so used with *one.*

In Chaucer we find, however, a slight variation from present usage in this respect. For examples we have:

> a true swynk and a *good* was he. Cant. Tales: Prologue, 531.—A theef he was, forsoth, of corn and mele And that a *sleigh.* Reeves Tale, 20.

[1] *Englische Grammatik,* vol. III, p. 182.

It is to be noted that whereas we now use the expression, *such a one,* Chaucer omits the article, thus:

> With *swich oon* as he is. Troylus and Cryseyde. Bk. V. 740.—To have a *newe.* Anelyda and Arcite, 277.—In love a *falser* herde I never none. Phillis, 5.—And cowde a *certeyn* of conclusiouns. Milleres Tale, 7.—For trusteth wel, it is an *impossible.* Prologue of Wyf of Bathe, 688.—The proverbe saith that many smale maketh a *gret.* Persones Tale.—To lene a man a *noble* or two or thre. Chanounnes Yemannes Tale, 26.

The use of *a* in the last example is somewhat different, however, because *noble* is so thoroughly substantivized. So also with an *evyle,* a *grene,* etc.

(*b*) The definite article. By Chaucer the definite article is often omitted where in modern usage it seems necessary. With plural personal substantives (without *-s*) we do not omit except in such couplets as *good* and *bad, old* and *young, wise* and *foolish,* etc. But Chaucer is much more free to omit the article.

> O trouble wit, O ire recheles That unavised smytest *gulteles.* Maunciples Tale, 175.—The way of *blynde.* Secounde Nonnes Tale, 92.—Victorious tre, proteccioun of *trewe.* Man of Lawes Tale, 358.—Now, lady bright, to whom alle *wofulle* cryen. *ibid.* 752.

Of course the personal substantives (with *-s*) are so far substantivized that the article may be used or omitted, just as with any other noun. This is true also of the plural abstracts.

With the singular abstract substantives the article may be used or omitted. With substantivized adjectives of color it is generally omitted as in Modern English. "a lady thus al in *blak.*" Knyghtes Tale, 600. Likewise with proper adjectives it is generally omitted. "Who couthe ryme in *Englissh* propurly." Knyghtes Tale, 600.

Neuter concrete nouns, made from adjectives, are used with *the* or without. "the *goodes* of nature." Persones Tale.—"For lak of *goode.*" Court of Love, 1142.

6. Use as adverbial substantives. Many adjectives substantives, which were undoubtedly abstract nouns at first, seem

gradually to have assumed the function of adverbs when used with prepositions. Of course it is difficult to draw any line between those which are still abstract nouns and those that are adverbial, but a number have been listed here quite confidently because they seem so very plainly adverbial.

The expression *atte last* or *at the laste* seems to mean little more than our adverb *finally.*

> And *atte last* this hende Nicholas Gan for to syke. Milleres Tale, 301.—Tho was I war, lo! *at the laste.* Hous of Fame. Bk. I. 495.—The expression *atte lest* or *at the leste* is also very common. Two days, *atte lest,* or thre. Romaunt of the Rose, 1684.—Loke *at the leest* thou have a pair. *ibid.* 2265.—To helpe delen his londes and dressen hem *to rightes.* Cokes Tale of Gamelyn, 18.—Amonges alle these othere *in generale;* And forthy see that thou, *in speciale.* Troylus and Cryseyde. Bk. I. 901.—God saith thou schalt not take the name of thy Lord God *in vayne* or *in ydil.* Persones Tale.—governeth alle *in comune.* Nonne Prestes Tale, 180.—sith this thing *of newe* is yeve me. Court of Love, 643.—To telle *in shorte,* withoute wordes mo. Troylus and Cryseyde. Bk. III. 185. So also the expressions, *for the beste, atte full, by right* (rightfully), *in ydel* (idly), *with wrong* (wrongfully), *in ernest, at large, atte meste, for fynal* (finally), *in certeyn, in hye* (on high), *for as much* (inasmuch), *from eterne* (eternally), *for soth, of old.*

F. Relative substantivation of native and Romance words.

With the question of the beginning of this process of substantivation, comes the suggestion that the French were responsible for it. It is not the purpose of this investigation to discuss that question, but at the same time a thorough study of the process in Chaucer requires at least a comparison of the words as we find them.

1. Of the personal substantives (without *-s*), the sources are as follows:

> (*a*) Old English words. *lesse, leste, more, meste, goode, beste, yonge, yongest, heigh, heighest, olde, fairer, feirest, worthy, worthieste, trewe, untrewe, ferrest, gultyf,*

*gulteles, wyse, wisest, riche, sike, fre, bonde, grettest, lowe, worst, dere, newe, konnyngeste, greye, swete, formest, blisfulle, stronge, wofulle, needful, harmful, rewfullest, leef, slye.*

(*b*) French words. *poore, gentilest, feble, humblest, innocent, coveytous, seint, suffrant, pacient, graciouse, bountevous.*

2. Personal substantives (with *-s*).

(*a*) Old English words. *eldres, halwes.*

(*b*) French words. *nobles, seyntes, gentils, innocents, penytentys, comunes.*

It is to be noted that in the case of these words which have been substantivized thoroughly enough to take on inflectional forms, the majority are of French origin. This might argue that the process of substantivation started with the French.

The figures for the different classes are as follows:

| | | | | | |
|---|---|---|---|---|---|
| 1. Personal (without *-s*).... | Old English— | 33 | | Romance— | 11 |
| 2. Personal (with *-s*)..... | " | " | 2 | " | 6 |
| 3. Abstract (without *-s*).... | " | " | 31 | " | 11 |
| 4. Abstract (with *-s*)..... | " | " | 5 | " | 1 |
| 5. Neuters ..... | " | " | 14 | " | 10 |
| Totals ..... | Old English | | 85 | Romance | 39 |

This summary does not include the few Latin words which appear for Chaucer. While these lists do not pretend to record every example of the substantivation of adjectives in Chaucer, yet they are so nearly complete as to give a fair presentation of conditions.

## III. GENERAL CONCLUSIONS

For the most part, in Old English, the adjective was used only as a personal substantive. This substantivation, moreover, seems to have been due almost altogether to the second cause given by Kellner, namely, the dropping of an unnecessary noun. This is

done very frequently even in the *Beowulf*. On the contrary very few examples are found of the other uses of adjective substantives, so common in later English.

Judging from conditions as we find them in Chaucer, we can not say that the *process* of substantivation in the fourteenth century was much different from that of the twentieth century. A large per cent of the examples which have been given can be paralleled in modern English. We substantivize as many of our adjectives as Chaucer did. In fact almost every adjective can be so used.

The narrowing in is in the *manner* of substantivation. We can not substantivize in as many ways as did earlier speakers of English. This is doubtless what Franz means when he says,[1] "Die Grenze, innerhalb deren die Substantivirung des Adjectivs möglich ist, sind in Shakespeare's Zeit noch wesentlich weitere als in der modernen Sprache." This is true especially with regard to the definite article. As a general rule we never think of omitting the article when we make personal substantives of adjectives. Where Chaucer said, "The way of blynde" we must write, "The way of *the* blind."

One exception to this rule is found in such couplets as *young* and *old, good* and *bad, wise* and *foolish, living* and *dead*. This is apparently an isolated survival of a use common in the time of Chaucer.

We find the personal adjective substantives in the plural, (with *-s*), at about the same stage of substantivation in Chaucer as in modern English. This seems also true of the adverbial expressions. *At last* appears, with Chaucer, to mean *finally,* just as it does to-day.

In the case of partially substantivized adjectives we find a complete change since the fourteenth century. Chaucer used the adjective with *one* very seldom; to-day it is our most common method of substantivizing. On the other hand, the adjective referring to a preceding noun as a good man and a *true,* was quite common in Chaucer's day and became even more so in Shakespeare's time; to-day we find few instances of such usage.

[1] *Shakespeare Grammatik,* p. 60.

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# UNIVERSITY STUDIES

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## I.—*Studies on Human Parasites in North America*
## I. Filaria loa


BY HENRY B. WARD


CONTENTS


1. Introduction
   - Origin and scope of paper . . . . . 2
   - Data on new cases in North America . . . . . 3
2. Cases of *Filaria loa* on record
   - List of genuine cases . . . . . 11
   - Cases wrongly assigned to *Filaria loa* . . . . . 22
3. Morphology of *Filaria loa*
   - Structure of the parasite . . . . . 26
   - Life history . . . . . 28
   - Taxonomy . . . . . 31
   - Geographical distribution . . . . . 33
4. Pathology of *Filaria loa*
   - Seat of the parasite . . . . . 38
   - Effects on the host . . . . . 40
   - Calabar swellings . . . . . 41
5. Clinical data
   - Case of Milroy . . . . . 46
   - Case of Lota . . . . . 48
6. Critical bibliography of *Filaria loa*
   - Annotated list of references . . . . . 50



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In February, 1902, Dr. W. F. Milroy, of Omaha, brought me a specimen in alcohol which he had just removed from the eye of a patient and which he believed to belong to the rare and interesting African species, *Filaria loa*. He expressed a desire that I make a more precise examination of the specimen and that our results be included in a joint communication. The study of this specimen demonstrated that it was in fact *Filaria loa* and disclosed some interesting features in the anatomy which, together with Dr. Milroy's clinical observations, were presented before the American Association for the Advancement of Science in 1902. Circumstances have delayed the appearance of the final paper beyond all expectation, and meantime a contribution by Looss (1904) has dealt with the anatomy of this species so fully as to cover all the points I had worked out. Indeed the admirable work of this author sets the limits for anatomical studies for many years to come. Accordingly, the part of this contribution dealing with the anatomy has been reduced to a brief summary.

Since this preliminary contribution, I have been fortunate enough to secure the data on several other cases in the United States which have not yet been published, and have had an opportunity to study six other specimens which have been sent me for that purpose. To all the gentlemen who have contributed so generously of their material and have cooperated so unselfishly in securing data on this interesting parasite, I desire to return here my sincere thanks. For these cases I have given the description largely in the precise words of the observer to whom I am indebted for the record. The more extended notes of Dr. Milroy are included in a separate section of this paper.

Through the courtesy of Dr. B. C. Loveland, formerly of Clifton Springs, but now of Syracuse, New York, I am able to give the following account of several interesting cases. In two he removed the parasites himself and one of these, that taken from the eye of Mrs. J., I have been privileged to study this summer. Of the identity of this specimen there can be no doubt, and in the other case the evidence is strongly in favor of its interpretation also as *F. loa*. The location and date lead

identify the case of Mrs. R. with the one reported by Wilson in 1890 and enrolled as case 31 in my list below. If so, three other specimens were removed from the same host and all these three from the eyelids: additional evidence in favor of assigning this form to *F. loa.* Regarding these cases Dr. Loveland writes as follows:

"About 1890 Mrs. R. was under my care and told me that she was the possessor of one of those worms which would make its appearance at times in the eye and at times come up close under the skin in some other region, where it would produce a sensation of stinging or irritation. I told her to call me at once when it should appear, as she said that it would disappear very quickly into the deeper tissues. She came to my office one evening and told me her worm had come to the surface on her back. And on inspection it appeared not far from the lower angle of her left shoulder blade, where it gave the appearance of a thread drawn in rather crookedly just as close as possible to the cuticle, where it could be felt as well as seen.

"I made a quick incision parallel to it in the middle, and grasping it with a pair of small forceps slowly withdrew it as it 'let go,' so to speak. It was of the type of nematode or round worm, about one and one-half or possibly two inches in length when stretched out, but contracted to much shorter. I had the misfortune to lose it while I was away on a vacation some months later—I think it was a *Loa.*

"In 1898, while still at Clifton, Dr. Spaulding called me into his office to see something in the eye of Mrs. J., an African missionary patient of his, the like of which he had never seen. I recognized what I thought to be the same worm and secured it at once. This worm I have to-day mailed you; it was, so far as I could tell, the same as the one I removed from the back of Mrs. R. in 1890.

"She [Mrs. J.] says they are quite common in that part of Africa, Batanga, West Africa, where she was stationed.

"She says that her husband and children have all had them. She also says that the worms make sores on the hands or feet and are sometimes captured at those times and places. It is only

occasionally that they produce a sore or abscess, and I think that is when, like the Guinea worm, they lay their eggs [embryos] or multiply in a given locality. This last is only hearsay.

"These cases came under my care incidentally and have never been reported."

From Dr. C. F. Friend, of Chicago, formerly a medical missionary of the Presbyterian Church in West Africa, I have been the recipient of most courteous information regarding a case hitherto unreported. Dr. Friend very kindly sent me the specimen in alcohol together with photomicrographs he made from the living worm, and also drawings of the specimen. There is no doubt as to the species, which is unquestionably *F. loa.* Regarding this case Dr. Friend says:

"This is the only specimen that I have ever removed, and it is that from Mrs. X.'s eye about four years after her return to America. I am sorry to say that I have lost or misplaced the notes made at that time or I would send them with this letter.

"While I have not removed a *Loa* from any part of the body other than the eye, yet I have thought that it did travel to other parts, for at different times both Mrs. X. and myself have seen what appeared to be the movement of the worm in different regions of her body. And I have thought that swellings which appear at times on her hands or arm and a time or two on her thigh were caused by the *Loa,* as she would have the sensation as of the movement of the worm prior to the swelling, but not always so. In fact, at times when we thought we saw the worm in the parts referred to there would be no swelling, and again when I have cut down upon the part when we thought we saw it, we did not find the *Loa.* On the other hand, I think Dr. Loveland did remove a *Loa* from under the skin of the back of Mrs. R. about 1890. The specimen I am sending you was removed early one morning from under the conjunctiva of the left eye near the outer canthus.

"The night before Mrs. X. had complained of a sharp, piercing, pricking sensation, or pain in the eye, which from previous experience she knew to be the movement of the worm, but I could

see nothing of it. Upon arising, she could see the worm moving across the eye downward and inward. Mrs. X. thinks that the worm when it appeared in the eye would nearly always, if not always, go out by way of the inner canthus.

"As quickly as possible I prepared the instruments, cocained the eye, and with a small pair of locked forceps grasped the worm and the tissues around it. This pair of forceps was then held by an assistant. I then took a lancet and cut down upon the worm, and with another pair of forceps grasped it, and after unlocking the other forceps pulled it out, when it wiggled much the same as an earthworm would do under similar circumstances.

"One peculiarity that I may mention regarding the action of the worm in this case is that at no time during pregnancy did Mrs. X. feel any movements of the worm. This was noted in two pregnancies prior to the removal of the worm I am sending you and in two pregnancies in regard to the worm yet in her system.

"When cut from the eye the *Loa* measured 32 mm. in length."

Through the brief mention of these cases made by Primrose (1903:1264) I became aware of two observations in Toronto that probably concerned *F. loa.* As no account of these cases has been published as yet I am glad to be able, through the courtesy of the two gentlemen, to present here the record of the same. It was more than ten years ago that Dr. F. N. G. Starr showed at a meeting of the Toronto Pathological Society a specimen of a filaria he had removed from a patient. The worm was not placed at the time, but subsequent publications on *F. loa* showed its close resemblance to that species, if, indeed, it is not identical with it, as I believe. Since the specimen was lost, final evidence can not be secured. Concerning the case Dr. Starr writes as follows:

"The patient, a female, and about thirty-five years of age, had been for some years a missionary on the West Coast of Africa, and because of broken-down health, caused by a series of attacks of fever, she returned. On her way here she had a worm

removed.[1] She presented herself to me with the following story: That at times she would begin to feel an uncomfortable suspicion of burning and fulness in some part of the body, and that after a time she could see something crawling under the skin. This would last a few minutes, and then the part where it approached the surface would swell up, be sore for a day or two, and disappear, the amount of swelling depending a good deal upon the location. For example, if near the eyelids there would be very marked swelling. Several times she came to my office, but by the time she reached there the worm had disappeared, and I began to think the life on the West Coast had affected her brain. However, at last she came and I saw the movement under the skin for myself.

"The appearance was of a thin, white line, drawing itself up, and then projecting one end forward like the movement of a 'caterpillar'; presently the forward end would begin to disappear, and finally the whole 'streak' would disappear from view. The next time I cut for it, but did so about its middle, and before I could pick up a pair of forceps to grasp it, the worm was out of sight. I then prepared a very sharp scalpel and a pair of fine pointed tissue forceps, and kept them in readiness, and after repeated attempts the patient came in. This time the filaria was crawling under the skin of the chest over the manubrium sterni. I cut the skin just behind the forward extremity and made a 'grasp' into the incision, when the patient assured me I had hold of it for she could feel it squirm. I pulled very cautiously, and a thread-like structure came out nearly two inches long, and about the size, I should say, of a No. 0 catgut suture material. There was never any recurrence of the trouble."

The second case in Canada occurred in the practice of Dr. Frederick Fenton of Toronto. He removed two specimens at different times from the eyelids of a patient. The specimens were identified as *F. loa,* and although the extended mss. record of the microscopical examination made at the time, which Dr.

[1] This specimen, of which I have been unable to get further information, was also removed in Canada.

Fenton was good enough to send for my use, gives nothing which absolutely confirms the diagnosis so far as the species is concerned, yet the details conform fully with *F. loa,* and the mention of such items as the well-known cuticular bosses makes the case reasonably certain. Both specimens were lost. The first and larger specimen, of which accurate measurements were made, was 55 mm. long and 0.5 mm. in diameter; the other was only 45 mm. long. The following data regarding the case are taken directly from correspondence from Dr. Fenton:

"Mrs. M., aet. 48, was an educated and refined woman, the wife of a missionary. Prior to 1897 she had resided for several years at Batanga, seventy miles inland on the Gaboon river. She first noticed trouble after returning to England in March, 1897. One arm and wrist became greatly swollen and remained so for several months, causing considerable inconvenience owing to degree of swelling, but little if any pain. On subsidence of the swelling, the part remained 'black and blue' for a long time. At times she suffers from fever, pains in back, and general malaise; there were occasional lancinating pains, as if the worm were cutting its way through the tissues.

"I saw her in September, 1898, with Dr. J. L. Davison, who had tried to remove one and failed from want of assistance. The outline of the worm could be plainly seen, lying beneath the skin of the upper eyelid. If touched, and at times when not irritated, it would wiggle through the tissues like a snake. The skin of the lid including the worm was grasped firmly with a pair of dissecting forceps and an incision made transversely, when the worm was seen lying at the bottom of the wound, looking like a fiddle string or a piece of silkworm gut, and was easily picked up and pulled out with a pair of forceps. It rapidly became stiff and hard after removal and was found to be 55 mm. long and 0.5 mm. in diameter, one extremity ending in a hook-like process, while the other is simply rounded off without any apparent thickening. In December of the same year I removed another, 45 mm. in length, from the lower lid, and in the spring of 1899 failed in an attempt to secure another.

"On one occasion the worm lay across the center of the field of vision of her left eye for some time, though a careful examination failed to discover it on the anterior surface of the eye; at that time the worm moved with the movements of the eye, being apparently within the eyeball itself. No ophthalmoscopic examination was made, so there was only the patient's history of the occurrence to suggest the penetration of the eyeball.

"These specimens were shown before the Toronto Pathological Society, and a brief history given, but no paper has been published concerning them. I saw this patient again in May, 1899, and up to that time she had had no further trouble."

The largest group of specimens I was privileged to examine came to me through the courtesy of Dr. J. H. Murphy and Dr. D. T. Vail of Cincinnati, Ohio. In addition to several fragments belonging probably to two worms, there were two perfect specimens of a female *F. loa* in alcohol and one specimen in balsam, probably entire, although both ends of the latter worm were badly mutilated or shrunken in mounting and so imperfectly cleared that it was impossible to determine the sex or the character of these parts of the body. The cuticular bosses, which were so well described and figured by Blanchard (1899) for *F. loa,* are distinctly visible, and the general appearance of the body, in comparison with other unmistakable specimens of *F. loa,* leaves little doubt that this worm belongs to the species under consideration. The precise determination of this specimen is all the more important since it is the one removed by Dr. L. from his wife's breast. He extracted one of these worms from the skin overlying the sterno-cleido-mastoid muscle and another from her left breast. One entire specimen in alcohol bears his name also on the label and is no doubt the other worm noted. It is a perfect specimen of a female *F. loa.* I think this is the first instance in which a supposed *F. loa* removed in life from any other part of the body than the vicinity of the eye has fallen into the hands of a helminthologist for careful examination and determination. In view of the very large number of *Filariae* already reported from Africa, even though the fauna is necessarily most imperfectly known, the reports of the extraction of

a *Loa* from other parts of the body than the eye have been received with some caution by helminthologists. This is clearly shown by the silence of Manson, Blanchard, and other authorities on this point, even though they cite in connection with some cases in the eye the popular opinion that such worms occur elsewhere in the body. In the present case we have the best of evidence, since the specimens in question were removed by a medical man, and on account of the importance of the matter I have subjected them to most careful scrutiny. While one is not in sufficiently good condition to render an absolute decision possible, there can be no doubt as to the systematic position of the other specimen. Accordingly, it may now be affirmed that the *F. loa* does make its appearance near the surface in other parts of the body than the eye. Since Dr. Vail has in preparation a paper to be read before the American Academy of Ophthalmology and Oto-laryngology at Buffalo in September, 1905, I forbear to trench further upon his field and refer to his paper for further details regarding these cases and for a discussion of the clinical factors.

## 2. Cases of Filaria loa on Record

Many authors have assembled the earlier records of this parasite, but in general the lists given have been inaccurate and imperfect. The series given by Blanchard (1899) is admirable in manner of treatment and is the most complete. It includes twenty-five previous cases and one new one. The method employed of listing all records quoted from a given paper as one case under the name of the author seems to me undesirable since it does not distinguish between the account of a single chance specimen and more extended observation. Here each case includes the history of only a single host, so far as this could be fixed, even though two or more parasites were removed from the one individual. If this method be criticised as incomplete, one can only reply that it is impossible to determine whether the multiple infection took place at a single time or through repeated introduction of the parasite. Only the positive demonstration of the latter condition would justify the interpretation of the nu-

merous parasites as separate cases of the disease. I have departed from this rule twice where the time interval was such as to justify the acceptance of the later record as a new case. So far as possible each case record includes the name, date, and place of observation, the sex, age, and nationality of the person infected, the number and sex of the worms, a statement regarding their removal, if accomplished, and the probable place and time of infection, and finally the place and date of publication. In some cases only a limited amount of data are given by the original recorder, and in many instances certain of these desiderata are lacking.

By no means all of the cases of which we have reasonably good information are included in the list, since some of the records, though distinct, are not definite enough to enumerate exactly in such a series. Thus Guyot (1805) speaks of several other individuals, on the coast of Angola; Wilson's patient says (Wilson, 1890) the disease is common among natives, and all the missionaries of that station, Benita near Gaboon, have them; Robertson's patient had seen such cases in the eyes of natives; Roth (1896) says his patient informed him that a number of people in her village complained of the same disease; while Miss Kingsley, the well-known African traveler, speaks of these filariae as abundant and fairly common in different regions on the West Coast of Africa. Such evidence might be multiplied concerning this part of the world.

Not all cases are equally clearly established. I have followed the general custom of previous authors in including cases in which the identity of the parasite has not been finally demonstrated. Indeed, were one to demand precise identification all the earlier cases and many of the later ones must be thrown out. Again, other species have been reported from the eye of man and some of those doubtfully attributed to *F. loa* in this list may belong to such species. In such cases the geographical location of the case or the past record of the infected person are of importance in determining the probable species of *Filaria* represented. Even thus no case has been included in this list except the weight of evidence was strongly in favor of the interpreta-

tion given. Under this treatment the total number listed becomes ninety-four, from the record of Mongin published in 1770 to those of the current year (1905), a time interval of 135 years. About two-thirds fall within the last twenty years, and half the total number have been published within the ten years from 1896 to date.

The matter of the earliest record calls for a word of comment. Pigafetta (1525) has been cited by Guyon (1864), Manson, Moniez (1896), and Blanchard (1886, 1899) as evidence of the occurrence of *Filaria loa* in Africa in the sixteenth century. This claim is based upon a plate, one figure of which is interpreted by these authors as illustrating the removal of an eye worm. It appears that this plate does not belong to Pigafetta's works, but to Lindschoten's; and even here it is not found in the original edition (1596), but occurs first in the De Bry reprint where it was probably inserted by the publisher. I have discussed the matter in detail elsewhere (Ward, 1905). The region described by Lindschoten lies in the Persian Gulf, and not in the Congo territory, where Guyon *et alii* located the account. It is thus well within the range of *Dracunculus medinensis,* but far removed from the habitat of *Filaria loa.* Furthermore the text makes no mention of infected eyes, but speaks of "worms in the legs" of the natives, which again accords with the Guinea worm. Hence the interpretation placed upon the plate must be rejected, and if, indeed, the plate itself has any standing as evidence, it concerns the Guinea worm rather than *Filaria loa.* This reference must accordingly be eliminated from discussions of the latter species. It is not listed here among the cases of *F. loa* which I have collected, verified, and arranged as follows:

1. Mongin at St. Domingo in 1770 records the extraction of one worm from between the conjunctiva and albuginea of a negress.

2. Bajon at Cayenne in 1768 removed a worm from below the conjunctiva of a negress eight years old; this case was first published in 1777 together with the following.

3. Also at Cayenne in 1771 Bajon observed in an older negress such a worm moving across the eye between conjunctiva and cornea, but was not allowed to remove it.

4. Mercier at St. Domingo in 1771 extracted a worm from beneath the cornea of a negress.

5. The same authority in 1774 removed from a negro a worm which lay above the cornea. The record of cases 4 and 5 was published by Arrachart in 1805.

6. Arrachart notes that in 1795 Mlle. L. Fraise, creole, born in St. Domingo, assured him that her brother had several times such worms in his eyes at the age of three to five years; they were successfully extracted. She also adds that young negroes were often attacked. This striking note seems to have been overlooked by students of the subject. The direct implication that the child was born in St. Domingo would indicate the existence there at that time of a center of infection for *F. loa,* such as is known to have existed for the Guinea worm (*Dracunculus medinensis*) at several points in the Western Hemisphere during the continuance of the slave trade. The alternative that some other species was involved seems less acceptable as there are no other records favoring this view, unless the South American cases indicate the rare occurrence there of a native species similar in habit to *F. loa.*

7. The French naval surgeon, Guyot, made several voyages to the coast of Angola. On one occasion, examining closely the eye of a negress, he saw what seemed to be a varicose vein in the conjunctiva, but when he touched it with the point of a lancet the object disappeared. It appeared several times in the same patient at irregular intervals, and he thought that between times the worm retired to the posterior region of the orbit. He recorded the native name of *Loa*, the common occurrence of the malady, the irregular appearances of the worm in the eye, and the inefficacy of all medication. The case was first published in Arrachart, 1805.

8–12. In 1777 Guyot made a new voyage to the coast of Angola. He observed again this verminous ophthalmia among the negroes of the Congo, and in two cases out of five succeeded in

removing the worms. The account of these cases was first published by Arrachart (1805:228, observations 7 ff.) and later by Rayer (1843). Guyot was the first to view this species as different from the Guinea worm. He says: "Je ne crois pas que ces vers soient de l'espèce du dragoneau, car ils sont trés blancs, plus dur et mois longs à proportion. Je ne jamais vu ce ver se faire jour de lui-même. Pendant sept voyages que j'ai fait à la côte d'Angôla, je n'ai vu aucun nègre attaqué du dragoneau. Plusiers chirurgiens qui ont navigué sur ces côtes m'ont assuré n'en avoir jamais vu."

13. M. de Lassus, army health officer of St. Domingo, removed a worm from the eye of a negro. The case is chronicled by Larry, 1812.

14. In 1828 a worm was seen in the orbit of a negress, recently arrived as a slave from Africa at Monpox, a village on the banks of the Magdalena river in United States of Columbia. This observation is attributed unmistakably by the original text to Clot-Bey, a French surgeon, well known for his work in Egypt about that date. The French authors agree in pronouncing this authorship an error and in substituting the name of Roulin. I have found neither explanation nor reference to Roulin or his works.

15. Dr. Blot, a physician on Martinique, in 1837 removed two filariae from the eye of a young negress who had come from the African Coast. One was sent to Guyon and Blainville, and described by the former (Guyon, 1838).

16–17. Loney, an English naval surgeon, in April and June, 1842, extracted moving worms from beneath the conjunctiva of two Kroomen on the West Coast of Africa. He reported these cases together in 1844.

18. Lallemant excised a worm from the eye of a negro in Rio de Janeiro, and in 1844 published a description of the case.

19. In 1833 Christovó José dos Santos removed a worm from the orbit of a Mina negress. Sigaud witnessed the operation and reported it in 1844.

20. Lestrille in 1854 removed a worm from the eye of a negro at Gaboon; his description of the case was published by Gervais et Van Beneden (1859).

21. Mitchell saw such a worm in 1845 at Trinidad. The host, a young negress, had come from the West Coast of Africa in 1834; the worm made its first appearance in the left eye in 1837, again in 1841. The specimen Mitchell saw was presumably at least eleven years old, although he infers wrongly that the various reports necessarily concern the same individual parasite. According to tradition one had been seen in a family in Antigua sixty years before. Mitchell reported his case in 1859.

22. In 1864 Guyon reported another specimen removed by a marine surgeon from a negro in Gaboon. Part of this worm remained entangled in the deeper tissues of the orbit.

23. In March, 1868, Dr. Maurel at Gaboon removed a worm from the eye of a native. Trucy (1873) reported the case as Observation III, in a paper on the Guinea worm.

24. Rev. Dr. Nassau, a missionary in Gaboon, sent in 1876 to Dr. Morton, a surgeon in Philadelphia, a *Loa* taken from the eye of a native woman. The worm was examined by Leidy, whose brief description and the account of Dr. Nassau, which also includes cases 25 and 26, were published by Morton (1877).

25. Rev. Dr. Nassau records that while he has never had the worm in his eye, he has yet seen it moving beneath the skin of his fingers. In Gaboon the worm shows itself at various points of the body of the host, in the fingers and eyelids as well as under the conjunctiva. He has seen the worms both in his own fingers and in those of other persons. The effort to extract one specimen from his eyelid failed by virtue of the activity of the worm. Though evidently incomplete, this observation furnishes the first suggestion that the parasite is not exclusively confined to the region of the eyes.

26. An English trader, Captain Stone, living on the Ogooue. had one removed from his eye by a native using a thorn as a needle. The case is quoted from a letter by Dr. Nassau in Morton, 1877.

27. Dr. Bachelor of Gaboon extracted a specimen from the eye of a native young man. It was on the iris beneath the sclera. This was the first perfect specimen sent to the United States. The case is reported in his letter (Bachelor, 1880).

28. Dr. Bachelor reported a year later (1881) the case of a white woman, a missionary near Gaboon, from whom at different times three such worms were removed. He also confirms the record (case 25) that Dr. Nassau, who was frequently affected, "had one in the areolar tissue between the thumb and index finger."

29. Dr. Falkenstein sent Leuckart from the Loango coast a specimen of this worm from the eye of a European, which was determined and reported as a species clearly distinct from the Guinea worm (Leuckart, 1881).

30. Dr. Lota, a French physician in Gaboon, experienced conjunctivitis after his return to France, and on careful examination saw such a worm beneath the conjunctiva. He noted its movements and demonstrated the case to several colleagues; but the worm disappeared before removal. His eyesight was not impaired. The case is chronicled by Terrin, 1884.

31. Mrs. ——, missionary at Benita, near Gaboon, had at intervals felt and seen such worms. She had one removed in February, 1889, at Basel, Switzerland, from the left upper eyelid, one in November, 1889, at Bridgeport, Conn., from the right upper eyelid; one in February, 1890, at Clifton Springs, N. Y., from beneath the skin of the back; and in July, 1890, one broke in removing it from the right upper eyelid. She says the worm is common in Benita and all the natives have them, and the author adds: "So far as I have been able to obtain evidence from the missionaries themselves, the filariae are more common in the cellular tissue than in the eyeball. From the literature we should infer the opposite." The worm was removed and the case reported in 1890 by Dr. F. M. Wilson of Bridgeport, Conn.

32. One other missionary at Benita had such worms removed. The fact is chronicled by Wilson (1890) on the direct testimony of his patient of case 31.

33. An infant negress from the Congo had a worm in the anterior chamber of the eye. It was reported by Coppez (1894), van Duyse (1895), Gauthier (1895), and Lacompte (1894). When extracted by the latter it was dead.

34. An English woman who had lived eight years in Old Calabar felt the parasite a month after her return to England, but

later thought it had disappeared, as one was passed *per rectum.* Eight months after her return a male was removed from one eye by Dr. Robertson and reported by him (1894, 1895). From the same patient he removed subsequently (1895:162) a female worm. Further history of this patient is recorded in case 73.

35. A woman who lived at Old Calabar from 1860 to 1863 had suffered while there from a worm in the eye. After her return she had a *Loa* removed in 1875 and a second in 1876. The case is recorded by Robertson (1894, 1895).

36–37. Dr. Thompstone, of Opobo in Nigeria, described two cases of *Loa* in natives. One was in the lower eyelid, the other beneath the conjunctiva. He was not able to remove either worm. These data were published by Robertson (1894, 1895).

38. In a woman at the same mission with case 33, the worm was seen to pass from one eye to the other over the bridge of the nose. It was not removed. The case is recorded in Robertson (1895).

39. A missionary in Old Calabar had a *Loa* which showed itself at irregular intervals for about fifteen years and then disappeared without having been removed. Robertson (1895) gives the record of the case.

40. Dr. J. R. Logan, of Liverpool, removed a male *Loa* from the eyelid of a patient. The blood of this patient was examined for filariae but held none. This worm was examined and described by Manson (Robertson, 1895). No further data are given.

41. A female *F. loa* was taken by a merchant from the eye of a negro at Cayo (French Congo) and sent to Berlin. The case was recorded and discussed by Hirschberg (1895).

42. In 1895 Dr. Saemisch extracted a *Loa* from the eye of a Russian marine officer who had been in Fernando Po from 1886 to 1891, and in Gaboon, Kamerun, and the Gold Coast from 1882 to 1885. The parasite was carefully described by Ludwig (Ludwig und Saemisch, 1895).

43. In July, 1895, Roth observed an extremely active *Loa* in the eyelid and just above it in a Jackrie girl at Warri, on the coast of Nigeria. He failed in the effort to remove it.

44–45. Later the same author (Roth, 1896) observed similar worms in two other natives without being able to extract them. He believed they passed out through the nasal duct. In spite of their frequence a reward failed to secure specimens.

46. In 1893 Barrett removed a worm from the eye of a young white man who had lived on the Gold Coast but had left there four years before and since then had resided in Melbourne; it was the first specimen removed in Australia. The worm was examined by Professor Dendy and determined as *Filaria oculi humani.* Barrett reported the case in 1896.

47–49. In three natives of Kamerun Dr. Plehn observed specimens of *Loa* in the eye. He attributed to the worm also the variable cutaneous inflammations found on the West Coast of Africa, and discussed them at length (Plehn, 1898).

50. In an English official Plehn also knew of a case, although he did not see the worm himself. According to the natives this worm occurs also in the eye in goats and sheep. He records these facts in the paper cited above (Plehn, 1898).

51. A French missionary who spent 1894–96 on the Ogooue in French Congo was relieved of a male *F. loa* by Dr. Bernard in 1898 at Paris. Bernard described the case (1898) and sent the specimen to Blanchard for study. This was in fact the second specimen taken from the same host; the first was described later (see case 52).

52. Dr. Leneveu removed a female *Loa* from the same host in August, 1897. The case is recorded by Blanchard (1899), who also gives an extended account of the anatomy of the two specimens.

53. Manson had a negro patient under his care in whose blood *F. diurna* abounded. When a lad he had a *Loa* in his eye. The case is recorded in Manson, 1893.

54. A lady long resident in Old Calabar had a *Loa* extracted from under the skin over the right clavicle. She informed Manson (cf. Manson, 1900:562) that if rubbing or scratching is not indulged in when a *Loa* approaches the surface there will be no swelling, and that Calabar swellings are produced by the rubbing solicited by the irritation caused by *F. loa.*

55. Annett, Dutton, and Elliott (1901) record that at Bonney they were fortunate enough to obtain a single female of this species for their collection. Since nothing is said regarding host and location, it is fair to assume its removal from the usual place, the eye of man.

56. The same authors received a female parasite taken from the eye of a Kroo boy by Dr. A. H. Hanley, medical officer at Opobo. In the blood of the host were embryos most similar to Manson's *F. diurna.*

57. Dr. A. H. Hanley also sent a male *F. loa* from the eye of a Kroo boy whose blood had no embryos at all. This case is recorded by Annett, Dutton, and Elliott, 1901.

58. In 1902 Dr. Milroy removed from a man who had been a missionary in Batanga a male *F. loa.* It was first observed in 1899. The case was first published by Ward (1902), but the full account by Dr. Milroy is found in this paper.

59. Dr. Rennes removed two specimens of *F. loa* from a European in Sierra Leone, where no previous case had been noted. The patient had been living in the Congo and had been in Sherboro only one year. One worm was removed from the eyelid and the other from the loose skin of the penis. The blood of the patient was swarming with embryos. The case is recorded by Prout, 1902.

60–61. Dr. Thompstone removed two males and two females from natives of Opobo, Nigeria, and sent them to Dr. Manson of London. They were described by Ozzard, 1903. No data are given regarding the hosts, but they were probably natives.

62–67. At the mission station of Yakusu near Stanley Falls, upper Congo river, Mr. S. S. found *F. loa* very common among natives. He saw at least six cases. The record was published by Manson, 1903.

68. Dr. Frederick Fenton of Toronto, Canada, removed two worms from the eyelid of a patient in September and December, 1898, and failed in 1899 in the effort to secure a third. The case was presented to the Toronto Pathological Society, but not published. It was noted briefly by Primrose (1903) and is published in full in the present paper (pp. 6–8).

69. Dr. F. N. G. Starr of Toronto, Canada, removed a filaria, probably *F. loa,* from a female patient who had been a missionary on the West Coast of Africa and had returned to Canada on account of ill health. The worm was taken from the skin above the manubrium sterni. The specimen was shown at a meeting of the Toronto Pathological Society about ten years ago. The case was briefly noted by Primrose (1903) and its data appear in full in the present paper (p. 5). Dr. Starr's observations are apparently the first made by a physician on the movement of such a parasite in the body outside of the region of the eye.

70. Dr. Habershon (1904) records from Yakusu, Congo river, that in Mr. K. S., afflicted with Calabar swellings, a *Loa* was seen to cross the conjunctiva.

71. Dr. Habershon (1904) also adds that the same conditions were observed in a native.

72. Dr. D. Argyll Robertson says that his patient suffered from Calabar swellings and noticed worms (*F. loa*) in her side, left shoulder, under the skin of both hands, under the abdominal wall, and in her right breast. The parasites were successfully extracted from the last two situations. The record was published in Habershon, 1904.

73. Dr. Robertson also records the case of another English woman from Old Calabar in whom *F. loa* was seen under the conjunctiva while she herself noted them under the skin of hands, wrists, breast, face, and scalp. Four attempts to remove them from under the skin of the nose, hand, and arm failed. He says further that there is no doubt that in many cases several worms are present in the same host. The record was published by Habershon, 1904.

74. A young French girl who had stayed several years at Libreville (Congo) was taken in 1902 with painful localized edemas of both hands and wrists, occasionally of legs, associated with some rigidity and loss of power. A white worm about the size and length of an ordinary pin was seen beneath the ocular conjunctiva, reappearing later beneath the skin of the eyelids of both eyes, of both forearms, and finally under the frenum of the tongue. Attempts to remove the worm failed. She returned to

France in 1903, and a *Loa* was extracted from the eye in January, 1904. An intense cosinophilia was noted in 1903, and though subject to fluctuations, continued after the removal of the worm. Probably other parasites also were present. The case is recorded by Wurtz et Clerc, 1904, 1905, and Kerr, 1904.

75. Rev. S. O. K., from Yakusu on Upper Congo, where he had been for three years, returned to England in January, 1904. Localized swellings, chiefly on the left forearm, first appeared after one year in Yakusu. Blood examinations showed microfilariae with diurnal periodicity well marked, hence diagnosed as *F. diurna.* The case was sent by Dr. Habershon to Sir Patrick Manson and described by Kerr (1904).

76. In a European who suffered from these transient swellings there was also a *Filaria loa* present and in the blood numerous embryo filariae which could not be distinguished from *F. diurna.* The case was observed by Dr. Hanley of Old Calabar and published by Kerr, 1904.

77. From a native of Old Calabar a *F. loa* was removed and found to be full of sheathed embryos indistinguishable from *F. diurna,* which were also found in the blood. No mention is made of swellings in this case by Dr. Hanley, whose account was published by Kerr, 1904.

78. At an autopsy of a Congo negro who died in Paris of sleeping sickness, Penel (1904:207) found more than thirty adults scattered through the superficial connective tissue of the four appendages, and despite most careful search not a single specimen could be discovered in the neck, face, or region of the eye.

79. In 1904 Looss published an account of the structure of *F. loa* based on three specimens from the Gold Coast; their source is unknown. They represent at least one case of human infection with this parasite.

80. At an autopsy of a native in Kassai, Brumpt found among other specimens encysted and so completely calcified as to be unrecognizable, a fragment of a *Filaria* encysted in the heart, which on return to France and comparison he identified as *F. loa.* It was a female and contained embryos identical with those in the blood of the same host. The case is recorded in Brumpt, 1904.

81. A specimen 60 mm. long was taken from beneath the conjunctiva of a man who had lived in Kamerun from 1897 to 1898 and since then in Germany. There was no intimation of the parasite until the day before removal. The case is recorded by Pick, 1905.

82. Dr. Hans Ziemann records (1905) that he had in his earlier service one case of *F. loa.* The host was presumably a native and the locality probably the same as that given for the following record.

83–86. The same author records the occurrence of four cases in his later service. Apparently he was stationed at Duala, Kamerun.

NEW CASES

87. Mr. K. observed that on one occasion when a Calabar swelling upon the back of a woman's hand was rubbed, such a worm was seen to emerge from the tumefaction and make its way across the metacarpo-phalangeal articulation, from which location it was extracted. These data are recorded by Milroy in the present paper (p. 47).

88. In 1890 Dr. B. C. Loveland removed a *Loa* from the skin above the lower angle of the left scapula of Mrs. R., formerly a missionary near Batanga, West Africa. Recorded in the present paper (p. 3).

89. In 1898 Dr. Loveland extracted a *Loa* from the eye of Mrs. J., also a returned missionary from Batanga, West Africa. The specimen I have described in this paper (p. 26), and the case is recorded here also (p. 3).

90–92. On the evidence of Mrs. J., her husband and children have all had the same parasite. The fact is recorded by Dr. Loveland in this paper (p. 3).

93. Dr. C. F. Friend removed a *Loa* from the eye of Mrs. X., formerly a missionary in West Africa, about four years after her return to America. This specimen is described in this paper (p. 26) and the data on the case are also recorded herein (p. 4).

94. The case of Dr. D. T. Vail of Cincinnati, O., briefly referred to in the preceding pages (p. 8) and reported at length

before the Buffalo meeting of the American Academy of Ophthalmology and Oto-laryngology.

### CASES WRONGLY ASSIGNED TO F. LOA

It is no matter of conjecture that other species of filaria than *F. loa* do occur in the human eye. In Italy, for example, Addario (1885) observed in the eye of man a nematode which he named *F. conjunctivae.* Later Grassi (1887) published an extended description of the same form to which he gave the name of *F. inermis.* He also discussed the cases of its occurrence in man and showed it to be a normal parasite of the horse and ass that, as an erratic parasite, occurs at times in the human eye. In spite of a certain similarity in general character its differentiation from *F. loa* is not a matter of any difficulty in case a precise examination is made of the specimen in question. However, when no such examination is recorded, the area of geographical distribution becomes determinative in general, and cases with insufficient data occurring within the range of this or a similar species will be referred to it by preference rather than to *F. loa.*[1] Thus the cases from Italy, in so far as they are not errors in observation, are naturally assigned to *F. conjunctivae* in the absence of more precise information as to the actual species concerned.

In similar fashion the case of Drake (1894) from Madras, India, is regarded by Blanchard as belonging most probably to *F. equina,* a common parasite of the horse and ass in that region and known in such hosts to make occasional incursions into the eye. The case of Neve (1895), also from India, in which the parasite was designated specifically as *F. loa,* appears to me to be undoubtedly an error in determination and to concern rather the species *F. equina.* I was unable to consult a copy of the paper by Macnamara (1863) which, to judge from the title, refers to cases also to be assigned to the species *F. equina*

[1] Reciprocally, it is just to assign to *F. loa* such cases as that of Maurel (Trucy, 1873) since the parasite was removed at Gaboon where the *Loa* is common, while it is beyond the range of the Guinea worm, to which the case is referred by the author.

(=*F. papillosa*) as occurring both in man and in the horse in India.

It is of great interest to note that in North America is found a species which occurs at times in the eye of the horse. Such cases are recorded for Canada by Sermon (1872) and for Pennsylvania by Turnbull (1878). In spite of the designation of the parasite in the first case as *F. oculi,* much used for *F. loa* by medical authorities, we are justified in attributing the case to some other species since the patient was a bay mare. Now the occurrence in this territory of a filaria in the eye of the horse necessarily casts a shadow of doubt upon cases in man in which the supposed *F. loa* was not carefully examined since, as has been noted, species of similar habit in Italy and India occur at times also in the human eye. It is indeed altogether likely that cases will occur in this country in which the horse parasite will, as an erratic, invade the eye of man.

In view of these facts one would be justified in expressing doubt as to the correctness of certain cases generally listed with *F. loa.* In particular the cases of Lallemant (No. 18), and dos Santos (No. 19), from Brazil may justly be questioned. To be sure, both were originally regarded as cases of the Guinea worm, and only by later authors have they been interpreted as *F. loa* by virtue of their occurrence in the eye. While I am inclined to regard this habit as sufficient reason for rejecting the original determination, it should be confessed there is some ground for doubting the assignment of the worm to the species *F. loa.* The cases are unique in Brazil, and there is no evidence that the hosts, although of negro blood, were recent importations from Africa. Now while there attaches some doubt to all cases in which a positive determination of the specimen was not made, yet, when the history of the host shows recent importation from Africa, as in many of those reported from the West Indies, the uncertainty is very slight. When the case history is not so clear the possibility of a chance infection with some form indigenous to the region is not definitely excluded. In other words, should future study show the presence in Brazil of some species such as is *F. conjunctivae* in Italy, the cases so definitely assigned

by previous authors to *F. loa* would necessarily be withdrawn from the list. That such species are found in Brazil one can not doubt in view of the investigations of Daniels on Carib Indians of British Guiana and of Magalhaes on various hosts in Brazil itself. That any of these species occur in the eye I have not yet found on record.

Other cases referred to by some authors as *F. loa* or listed in probable connection with that species should be stricken from the list on other grounds. One of the most difficult to explain satisfactorily is the case of Barkan (1876). The patient, an Australian, was operated upon in San Francisco for an eye worm, and the specimen, which was submitted to Dr. H. Knapp[1] of New York, was pronounced upon microscopical examination to be *"Filaria medinensis."* There was no evidence that the patient had ever been in any region where either the species noted or *F. loa,* with which it might easily be confused, is endemic. Consequently I am inclined to believe that the form was an Australian filaria normally occurring in some other host, but in this case appearing in man as an erratic.

For various reasons noted in the bibliography one is not justified in assigning to *Filaria loa* the cases of De Mets (1876), Kuhnt (1892), and Nordmann (1832). Although in all three cases nematodes were actually demonstrated, they are so unlike *F. loa* that their distinctness from this species can hardly be questioned. Still less connection with *F. loa* have the cases of Eversbusch, Fano, Malgat, Piccirilli, Quadri, and Schöler. The specimens of Piccirilli were observed in the anterior chamber of the eye, the worm seen by Schöler was in the lens, the other objects were all located in the vitreous body. All of these cases agree in that the supposed filaria was observed living in the eye by means of the ophthalmoscope. Such evidence is exceedingly questionable; in most instances manifests its weakness on close examination of the record, and in one case at least (Fano) demonstrated its insufficiency by a second examination eight years

[1] Dr. Knapp kindly informs me that, at my request, he has made every effort to trace the specimen, and that he fears it has been destroyed.

later than the original, which disclosed only trivial changes in the position and character of the object. One may also infer that in one case at least (Eversbusch) the author became convinced of the insufficiency of his evidence, since only a brief preliminary communication has appeared and the extended report which was promised therein has not been published. Subsequent authors have not hesitated to pronounce these observations erroneous and to maintain that in fact the authors mentioned had to do with cases of a persistent hyaloid artery in which this vessel exhibited a peculiar worm-like form, while the supposed twistings of the filaria were only the results of vascular pulsations or of movements in the vitreous humor. The explanation accords fully with the original records, as I can distinctly affirm after a careful study of them, and indeed elucidates certain points otherwise inexplicable, such as the statement of Fano (1868) that the head of the worm remained constantly fixed at a given point while the body turned and twisted about. Since I have been unable to trace the references to Chiralt and to Santos-Fernandez, it is impossible to say whether these cases of a filaria in the vitreous humor are to be explained on the same basis or whether a filaria was actually present.

Quite recently Nakaizumi (1903) has reported a case of a filaria in the vitreous humor which he regarded as an immature *F. loa.* This conclusion appears entirely inadmissible, even though one rejects the opposite extreme of interpreting this case like those just discussed as some abnormal structure belonging to the eye itself rather than as a filaria. The history of the case gives no evidence that the patient had ever been in a region where *F. loa* was endemic and consequently where an infection with this species could have taken place. Furthermore, no evidence is adduced to indicate the specific character of the filaria observed. If, then, one grants that the object actually was a worm belonging to the genus *Filaria,* it is certain that it could not have been *F. loa,* but was some species indigenous to northern Europe, and probably *F. conjunctivae* or *F. equina.* The habit of the patient, who is said to have enjoyed half-roasted horse flesh, may indicate an infection with a young *F. equina.* It is exceedingly unfortunate that the literature of science should

be loaded down with such incomplete observations, and these are entirely unnecessary when the observations are made at such a time and place as that in question, where accurate data regarding these species were easily obtainable.

For reasons given *in extenso* elsewhere (Ward, 1905) and already noted in the present paper, we must reject the classic reference to Pigafetta, more correctly Lindschoten, as the earliest authority to record a case of *F. loa.*

## 3. Morphology of Filaria loa

### Structure of the parasite

The appearance of the admirable account of Looss (1904) makes any extended consideration of this topic superfluous. Only those points are noted which are peculiar to the specimens of this paper.

In all I studied carefully three males, those removed by Drs. Friend, Loveland, and Milroy, and have examined two others, probably males of *F. loa,* sent me by Dr. Vail. I have had only one female, an alcoholic specimen removed by Dr. Lippert and sent me by Dr. Vail.

One male from Dr. Vail measured about 16 mm. in length, though the shrunken condition of both ends makes this measurement only approximate; the other male of this collection was not complete. The male *Loa* in alcohol from Dr. Friend measured 25 mm. in length,[1] and the specimen from Dr. Loveland, which was mounted in balsam and appeared somewhat shrunken, was about 22 mm. in length.

In no one of these males was the tip of the tail as straight as figured by Looss, but curved distinctly though only gradually. From my original notes on the specimen of Dr. Milroy I excerpt the following:

The specimen measured approximately 28 mm. in length and in alcohol was of a clear brown color, with distinctly marked lateral lines. The slightly reflexed posterior end and projecting spicules showed it to be a male. A more careful examination of

[1] Dr. Friend gives the length of this specimen living as 32 mm.

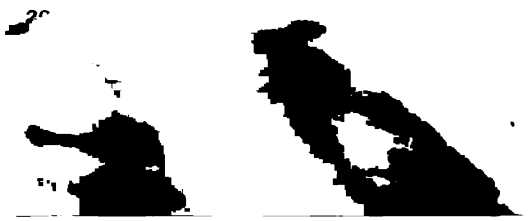
this region disclosed the four pairs of large circumanal papillae characteristic of *Filaria loa*. One important feature was noted in this connection. These papillae do not constitute four bilateral pairs, but rather a left and a right series of four each, in which the individual papillae alternate with each other, those of the left side being the more anterior, while those on the right are more closely crowded together. The anterior papilla is also the largest in each series, and the size decreases regularly posteriad.

This asymmetrical arrangement originally described by Looss is not an abnormality in the specimen he studied, and I can confirm his view that it is a general characteristic. At least it is actually present in the three males I examined and will no doubt be found on more extended examination to be universal.

Posterior to these large papillae lie, first, a symmetrical pair of small papillae and then, almost at the tip of the body according to Looss, a minute pair, also symmetrically placed. The latter I was unable to find.

In the specimen received from Dr. Loveland, the spicules could be most clearly seen; their length was 104$\mu$ and 180$\mu$, measurements which accord closely with those given by Looss. Further than this my observations, though in some respects less complete, merely confirm the anatomical description given by Looss. It is important to call attention to the results of a comparison of measurements of *F. loa* given by various authors, and since only relatively few have given sufficient data for the determination of the sex of the parasites, the figures available are much more limited than the number of cases.

According to various records the measured length of the male is 22 mm. (Blanchard), 23 mm. (Looss), 25 to 30 mm. (Manson), 30 and 35 mm. (Ozzard), and 16, 22, and 25 mm. (Ward). It is noteworthy that the female varies more widely: among the measurements given are 20 mm. (Blanchard), 50 mm. (Annett, Dutton, and Elliott), 52 mm. (Looss), 27 mm. (Lueckart), 41 mm. (Ludwig), 32.5 mm. (Manson), 50 and 55 mm. (Ozzard). Blanchard notes that his specimen was still young, and yet even that of Looss was far from having attained the size of Maurel's specimen, which measured 70 mm. and which from its extreme



length we are justified in regarding as a female. The specimen reported by Brumpt (1904) measured 60 mm. and yet it was only a part of a female, both head and tail being lacking. The specimens of the female taken from the eye are thus usually if not always only partly grown.[1] How much they fall short of full size can only be determined by the records of specimens, taken from post-mortem examinations, which have settled down in deeper tissues and are found to be producing embryos.

## LIFE HISTORY

Concerning the life history of *Filaria loa* only meager facts are at hand, and yet they are so clearly related that one may sketch the main course of development with great probability. Manson (1893) was the first to suggest that the blood-inhabiting embryo called *F. diurna* was the young form of this species. The agreement in the geographic distribution of the two forms, the certainty that in the infected region the embryonic stage of *F. loa* must be common, and the absence of any other microfilaria made the genetic connection of the two almost an established fact. Yet the negative results of blood examination in several cases which harbored *F. loa,* especially that of Robertson (1895) from which both male and female *F. loa* had been removed, served to cast doubt upon the view. Such doubt was distinctly unjustified since, as I have pointed out, the forms extracted from the eye have been consistently immature and may have been removed before the female has begun the production of embryos.

These conditions of probable slow development and of immaturity when in the eye agree well with known facts from related species of *Filaria* in other animals. Thus *F. equina,* a common parasite of the horse and ass, which occurs at times in the eye of the host, is found there in the semi-adult form which is also an active migrant. *F. labiato-papillosa* of deer and cattle appears,

[1] If the record of Guyon (1864) that his specimen was 15 cm. long does not rest on an error in transcribing or printing, it represents a much larger and hence more nearly full grown female than any other yet recorded. Ludwig has already shown that this case in all probability concerns *Filaria loa* (cf. Ludwig und Saemisch, 1895:737).

when immature, in the eye; and in a large number of cases, immature nematodes of unrecognized species, often belonging to the genus *Filaria,* have been removed from this organ.

The embryonic form circulating in the blood vessels must evidently be removed from the body of the primary host by some species of blood-sucking insect. Manson thought that by virtue of the appearance of these embryos in the peripheral circulation during the daytime some day-biting insect must be responsible for the transfer. He suggested the Mangrove fly, *Chrysops dimidiatus* v. d. Wulp., a common form in the region in question. These conclusions were attacked by Annett, Dutton, and Elliott (1901) without their being in position to furnish any very decisive evidence for the view they advance of the identity of *F. diurna* and *F. nocturna.* More recently Brumpt has brought forward strong evidence in favor of Manson's view in that he has discovered embryos of *F. diurna* in the circulating blood and identical forms in an adult female *F. loa* from the same host. He noted also that the embryos were constantly present in the peripheral circulation, even though more abundant by day than by night. The effort to discover the intermediate host in a species of *Glossina* was unsuccessful. If the observation of Brumpt that embryos are constantly present in the peripheral circulation is confirmed, then it is evident that the intermediate host may be a mosquito, as in the case of other species of *Filaria.* Annett, Dutton, and Elliott found that *Anopheles costalis* served in West Africa as intermediate host for *F. Bancrofti* but not for *F. diurna.* This observation will not exclude other mosquitos also; however, it does speak strongly against their view of the identity of these two microfilariae.

Whatever may be the precise character of the intermediate host, of the changes passed through by the embryo filaria within it, and of the method by which it is introduced into the human body again, it is evident that the actively migrating *F. loa,* that form best known from cases on record, is the semi-adult worm. In some cases this has appeared within about one year after the host has entered infected territory and in other cases as much as five, eleven, or even thirteen years have elapsed since leaving

such infected regions before the parasite has made its final appearance in the eye. During this time it has undoubtedly made some growth, and at the end of the wandering stage it tends to settle down in deeper tissue. Here the female probably gives birth to the characteristic multitude of embryos which in the circulating blood await the chance of being drawn out into a suitable intermediate host, to follow out again the same life cycle. The adult ultimately becomes encysted and calcified by the activity of the tissue of the host, and Brumpt found four out of five adults in this condition in the case he observed.

It will be noted that in reality the discovery of *F. loa* in the eye of a patient in whose blood *F. diurna* is present can not be more than an indication of the relationship of the two; for if the view just advanced is correct the wandering form is not fully mature, and consequently the embryos, if present, must come from *F. loa* of an earlier infection, and not from the form observed at the same time. This would evidently serve to explain the absence of embryos in those cases, such as Robertson's already noted, where male and female were taken from the eye and yet blood smears from the host showed no microfilariae present. Among natives in a badly infected region successive infections will be the rule, and wandering semi-adult forms will coexist along with parturient females in deeper tissues and embryos in the circulating blood. In hosts infected during a briefer residence in the infected region such conditions would be little likely to obtain, and embryos would be sought successfully in the blood only after the cessation of these migrations, when the worm is said by many to have disappeared from the body.

What time interval is necessary for the attainment of the full grown form is not clear. Certainly migrations continue for many years after infection. In the extreme case noted, a worm was removed from the eye thirteen years after leaving infected territory (case 35), and in another, also recorded by Robertson, the parasite is said to have shown itself at irregular intervals for fifteen years before final disappearance into deeper tissues. In the case of natives frequent cases of infection in early life

have been noted; thus the few cases first recorded from the West Indies include two of children, while in Europe that of Lacompte (No. 33) concerns an infant Congo negress. One missionary in Africa notes that the work of the native children in school is interrupted by the periodical visits of the parasite to the eye. This early infection in the case of natives will insure the attainment of maturity by the parasite and the presence of embryos in the blood of the adult negroes even though the development of the parasite proceeds very slowly, while the same slowness in development would render it unlikely that embryos could be obtained from the blood of hosts who had been exposed to infection first in middle life. This would serve to explain the absence of embryos from individuals as heavily infected as Robertson's patient who, even ten years after the first infection, had no embryos[1] in her blood (cf. the recent account of this case in Habershon, 1904).

Looss (1905:167) has already called attention to certain differences in appearance between the illustrations of *F. diurna* given by different authors. This indicates either a confusion of what are distinct species, as he suggests, or slight differences in structure due to age of the embryos and accompanying growth or ecdysis. The descriptions of these microfilariae are so general as to render a precise comparison difficult. In fact Brumpt originally regarded the embryos which he observed in the circulating blood as a new species which he denominated *F. Bourgii,* but later acknowledged their identity with *F. diurna.* It remains uncertain even yet whether the latter name may not include more than a single species.

## TAXONOMY

All the earlier observers regarded the eye worm as an erratic Guinea worm. In 1805 Guyot recorded the evidence, already quoted in this paper, which led him to the view that it was dis-

[1] Ziemann (1905:421) emphasizes the difficulty of determining the fact, and says that to demonstrate the embryos in the blood it is necessary often to try for several days and nights and to take blood from the region of the swellings. The distribution of the microfilariae in the body is exceedingly irregular.

tinct from that species. He also noted the name *Loa* under which the form was known to the natives. Later authorities denominate this a generic term for worm rather than a distinct designation for this form. The citation of the date 1778 is certainly incorrect as his paper was first published in 1805; apparently also he does not use the binomial form *Filaria loa* at all, so that, if adopted, this name must rest upon some later authority. I do not feel called upon to suggest any change at present.

Despite Guyot's view of its specific distinctness the parasite continued to be confused with other forms or to be denied specific rank as late as 1851, the appearance of Diesing's monograph. In 1881, after having had opportunity to examine a specimen sent from Loango, Leuckart passed definitely and favorably upon the question of its distinctness; and in 1886 Blanchard's paper settled finally the rank of the species. The work of many later authors has aided in strengthening the position then assigned to it.

The parasite certainly belongs to the genus *Filaria* as now generally accepted, and the proposal of Diesing and Cobbold to transfer it from this to the related genus *Dracunculus* which includes the Guinea worm was so evidently an error that in a later edition Cobbold himself reversed his former action.

The synonymy of the species is confused and depends in part on the positive determination of specimens for which no accurate data can ever be given. A partial list of the names used by various authors is given here for reference.

*Filaria medinensis* Gmelin 1788, in part.
of Diesing 1851, in part.
*Filaria lacrymalis* Dubini 1850, nec Gurlt 1831.
Dujardin 1845:46.
*Filaria oculi humani* Dujardin 1845:46.
*Filaria oculi* Gervais et van Beneden 1859:142; nec von Nordmann 1832.
Moquin-Tandon 1859, in part.
De Bonis 1876:129.

*Filaria subconjunctivalis* Guyon 1864 of Braun 1902.

This term is not used by Guyon himself either in this paper or elsewhere so far as I can ascertain.

*Filaria loa* Guyot of Leuckart 1876:619.
of Davaine 1877:cvii,+839.
of Cobbold 1879:205.
of Blanchard 1886.
of Stossich 1897:21.

*Filaria loa* Guyot 1778 of Railliet 1893.
of Braun 1895.
of Moniez 1896.
of Braun 1902.

*Dracunculus oculi* Diesing 1860:697.
*loa* Cobbold 1864:388–89.

GEOGRAPHICAL DISTRIBUTION

The first six cases of *Filaria loa* recorded were all from the West Indies and the adjacent coast of South America, while among the first twenty-one cases listed twelve were from that same region and only nine from Africa. In all of the cases from the West Indies and South America the hosts were negroes with the exception of the creole child of case 6.

As already noted, this case would seem to indicate the existence at that time (approximately 1795) in St. Domingo of an endemic center for this parasite. But this is the only evidence that *Filaria loa* has at any time gained a footing in the lands into which it has been introduced. It is noteworthy that since 1845, the date of case 21 mentioned above, no one has recorded the occurrence of this parasite in the West Indies or in South America. Apparently its occurrence in that region stopped with the cessation of the slave trade, for all of the cases noted were in negroes, and in some cases it stands definitely recorded that they had come from Africa. Thus the worm which Mitchell saw in 1845 (case 21) had apparently been seen eight years before, and the host, a young negress, had come from Africa in 1834. The single exception, beyond case 6 already discussed,

was in case 19 where the worm was removed from the orbit of a negress said to belong to the Mina race of Brazil. It must be noted that at best the determination of the species in these twenty cases is only probable, and confusion with *Dracunculus medinensis* is not excluded, while possibly rare cases of native American species showing similar habits may also be included. In any event it is important to note the complete disappearance of these cases from the West Indies and South America just about three-quarters of a century after the first one was recorded. Thus far also the negro race might be looked upon as the distinctive host of this parasite, as indeed some authors maintained even much later than this date.

The first recorded specimens which had been taken from Caucasians were described by Morton (1877) and Bachelor (1880), while the next, that sent Leuckart from Loango and described by him in 1881, is also the first one positively identified as a distinct species capable of differentiation from the Guinea worm with which the majority of previous observers had classed this parasite. Following close upon this case numerous others in Caucasians definitely established the fact that the parasite exhibits no racial preference in its hosts.

The first case recorded in Europe was that of the French physician Lota (case 30), who had previously lived in Gaboon and after his return to France found himself infected. In this case the parasite was not removed. In France there have been listed four other later cases (Nos. 51, 52, 74, and 78) in all of which the parasites were removed. All five cases probably originated in the French Congo. A time interval of fifteen years separated the first from the other three.

The French Congo was also the probable source of infection in the single case in which the worm was extracted in Switzerland (No. 31) and in that from Belgium (No. 33). The first specimens extracted in Germany (No. 42) probably came from western Africa, even though the extensive travels of its host render the exact region of infection impossible to determine; the second (case 81) from Kamerun. In England six specimens have been removed. In the first five cases the source of the

infection was Old Calabar, in the last it was the Congo. Australia has had one case (No. 46) in a host who had resided previously on the Gold Coast.

Regarding the presence of *Filaria loa* in the western hemisphere Clemow (1903:610) writes that "formerly it was said to have been seen from time to time among negroes in America, but since the slave trade from Africa to the New World has ceased this parasite is no longer found on the other side of the Atlantic." This statement holds good for the West Indies and South America, where, as already noted, no cases have been recorded since 1845. But as regards the northern hemisphere it is doubly incorrect, both as to former times and as to present records. On the one hand, it is noteworthy that no cases are listed on the North American continent from the days of the slave trade. One can hardly believe that such did not occur, but they seem to have escaped record in the literature so far as I have been able to follow it. On the other hand, there are not wanting recent cases in North America. The first case which actually occurred within the United States (No. 31) was reported in 1890. Here the host had sheltered four of these parasites, three of which were removed in this country. There are, to be sure, earlier records of *Filaria loa* in American literature, for Leidy had examined and reported briefly in 1877 on a specimen sent Morton from Gaboon by Rev. Dr. Nassau, an American missionary. Also in 1880 Dr. Bachelor reported on a specimen he sent from Gaboon, said to be the first perfect specimen of *Filaria loa* seen in the United States.

The second specimen reported in this country was that of Milroy which I recorded in 1902, and previous to the appearance of the present paper no others were found on record as having been removed in the United States. In the preceding pages (p. 3, ff.) I have discussed two specimens of Loveland, one of Friend, and one of Vail, which must be added to the list. Of these six specimens the first was probably acquired in the French Congo and the other five in Kamerun where the hosts had been resident. Two cases (Nos. 68, 69) have been recorded from Canada in 1903 and are fully discussed in the preceding pages.

It is noteworthy that all of the persons affected were missionaries in those regions, and all but one had suffered from the presence of more than a single specimen of the parasite, which fact points distinctly to its prevalence in the regions in which they had lived. In further support of this view may be cited also their own testimony on this point as already given.

In the foregoing paragraphs have been analyzed all cases of this parasite from other regions than Africa, and it has been shown that they are widely scattered both in time and in space, and also that in all cases there is an apparent connection with a previous residence of the host on the African continent. It is accordingly fit to examine more in detail the evidence concerning the abundance and distribution of *F. loa* in that continent.

All records indicate that the West Coast of Africa is the proper home of the parasite. One case which is reported from Sierra Leone marks its northern limit of extension. And even here the author (Prout, 1902) emphasizes the fact that no previous cases had been reported in this region, and that the patient had been living on the Congo, so that the infection probably occurred in the latter place. The specimens of Looss (1904) came from the Gold Coast, but no further information as to their source has been published, nor are other cases from this region on record, although the host in case 46 is believed to have become infected in this territory and said such cases were common in that region.

From this point onward along the coast towards the south every territory has furnished many records of this disease. In Nigeria ten cases are on record in my list, from Old Calabar five cases, from Kamerun eight cases, from French Congo twenty cases, from Angola six cases. Eight cases are not precisely located, but belong to some part of this Western Coast. In addition it has already been noted that the thirty-six cases of this parasite from Australia, Europe, and America owe their infection with great probability to this same region, eight being traced clearly to the Congo, eight to Kamerun, and six to Old Calabar, while in one case the host has visited this entire region at intervals.

Clemow is in error when he writes (1903:610) that it seems to be absent from Kamerun. In a monograph on the Kamerun coast Plehn (1898) recorded four cases in man and other facts regarding this parasite which demonstrate unmistakably its endemicity in that region. To this evidence one must add that given in the present paper on cases in Americans who were undoubtedly infected in that same state where they resided as missionaries for some time.

These facts indicate that the parasite is distributed over the entire coast from about 5° north of the equator to at least 10° south, and various observers say that in certain regions nearly every inhabitant suffers from it. This is recorded for the Ogowé river by Miss Mary Kingsley, the well-known African traveler (1897:686).

How far it may penetrate into the interior of the continent is as yet unknown. Certain it is, however, that cases occur more than 120 miles from the coast (Yarr, 1899), while a recent paper (Brumpt, 1904) records its presence in a post-mortem made in Kassai, approximately 600 miles from the coast on one of the chief tributaries of the Congo. More precise knowledge of the life history, especially of the intermediate host and means of transfer of the species, would enable one to give a better estimate of its range. Apparently the blood-inhabiting embryos which are now regarded as belonging to this species have a much wider distribution than *F. loa* itself.

Thus it is true that *Filaria diurna* has been recorded as far inland as Uganda, Central Africa, where Cook (1901) saw two cases. One should bear in mind that our knowledge of the microfilariae is not sufficiently exact to enable the positive assertion that no other form exists in Africa which might be confused with the embryos of *Filaria loa.* But granting the certainty of the determination, there yet remains reasonable probability that the men in question were infected at a distance from the place in which they were examined. Cook also records in Uganda one case of *Dracunculus medinensis,* showing the tendency of movements over the great trade routes of the continent to bring together this species and *Filaria loa* which in general

have each its own territory and so far as present records show do not occur together in any region.

The occurrence of *Filaria loa* in negro slaves, in travelers, in government officials, and in missionaries points out distinctly the certainty with which any kind of intercourse between nations and geographic areas tends to transfer to new races and territories the diseases of the old. Increased means of communication and growing freedom of movement contribute clearly to the spread of maladies and call for better means to check their advance into new regions. It is not to be doubted that some of the persons who brought *F. loa* into the United States now harbor its embryos in the blood. Though we know nothing precise of its life history, the possibility lies close at hand that some blood-sucking insect may furnish these embryos proper conditions for further development and may thus bring about the introduction of a new disease into our territory. Such cases as these of *F. loa* show clearly the gradual spread of disease through national intercourse.

## 4. Pathology

### Seat of the parasite

In many cases no more definite information is given than that the parasite occurred in the eye. In the absence of more specific details this may probably be construed to mean crossing the eyeball beneath the conjunctiva but above the cornea or sclerotic; in numerous cases, indeed, such a location is definitely assigned to the parasite. All in all, this is the most usual position of *F. loa* in the cases thus far on record; however, for reasons to be given later it is probably only an accidental occurrence and not the normal seat of the parasite. While most frequently recorded on the surface of the eyeball yet accurate records are not wanting to show that the parasite does occur, if infrequently, within the bulbus oculi. From the anterior chamber *F. loa* was removed in the case of Mercier (No. 4, but not in No. 5 as Kraemer incorrectly says), also in the case of Bachelor (No. 27), of Lacompte (No. 33), and possibly of Barkan, if this most doubtful account be interpreted as concerning *F. loa*.

From the lens this species has not been extracted, and those cases in which such a form has been reported from the vitreous humor are most uncertain. They rest in the main upon determination in life by the ophthalmoscope. But this method of procedure has resulted, in some cases at least, in confusion with a persistent hyaloid artery of peculiar form, as in the descriptions of Eversbusch, Fano, Malgat, Quadri, and Schöler, while the oft cited account of Kuhnt concerns a peculiar small nematode, certainly not the species under consideration.

Roth is of the opinion that these parasites leave the eye by way of the nasal duct. More probably this is only apparently true, since, as Dr. Friend suggests (p. 5), the worm nearly always goes out of view by way of the inner canthus.

Outside of the eyeball *F. loa* has been reported at least ten times as occurring in the eyelid, both upper and lower lid having been infected. From this position it has been removed six times or more.

*F. loa* has also been reported as wandering back into the orbit, as in cases 14, 19, and 22, and while no one of these cases is beyond doubt as to the species in question or the location of the parasite, there seems to be no question, on the other hand, that the loose connective tissues of this part afford the most ready resting place from which the parasite may make its excursions over the cornea at short intervals, as reported by several observers.

When in other parts of the body than the eye the parasite eludes observation in general, but it is important to note that nevertheless it has been seen and extracted many times in other regions, especially in the subdermal connective tissue. Thus it has been observed to cross the bridge of the nose from eye to eye (case 38); it has been excised from below the loose skin of the back (cases 31, 54, 88), from the skin above the sterno-cleido-mastoid muscle (case 94), the sternum (case 69), and the left breast (cases 72, 73, 94), from the lingual frenum (case 74), from the loose skin of the penis (case 59); it has been seen beneath the skin of the fingers, both in himself and in others, by the Rev. Dr. Nassau, a missionary long resident in Gaboon

and well known as a student of the religious and social customs of the negro races; it has also been extracted from the metacarpo-phalangeal articulation (case 87). Ziemann (1905) records that the worm is said by his patients to wander about under the scalp, and others maintain its presence in various other parts of the body. According to report of post-mortems the adult form occurs almost anywhere under the skin, but especially in the appendages (cases 78, 80).

In view of all the evidence the superficial connective tissues must be regarded as the true seat of the adult parasite, and its occurrence in the eye or indeed in other adjacent parts is more or less accidental and occasional.

## EFFECT ON THE HOST

When in the eye *F. loa* is the cause of temporary piercing or lancinating pains as it makes its way through the connective tissue. This pain is also accompanied by the sensation of a foreign body in the eye, and in case it crosses the field of vision there is added an uncertain image of the object. Both the pain and the sensation of the presence of some foreign body cease promptly with the withdrawal of the parasite into deeper tissues, while even repeated visits leave no permanent effect upon the organ other than to produce a very slight elevation of the conjunctiva, as Lota reports from observations on himself which one may consult (p. 49) for further details. In fact, the annoyance is so slight and of such brief duration as hardly to call for medical aid at all. Removal from the eye is not difficult when regard is had to the activity of the parasite and its tendency to flee at once when touched by any instrument. Even the natives in Africa practice its extraction with the rudest sort of instruments, in some cases using only a hooked thorn. In the earliest cases observed by European physicians it is recorded that such removal is unaccompanied by any untoward symptoms and is followed by complete recovery in a very brief time. So far as I have found, the same results uniformly follow the removal of the worm, from the anterior chamber as well as from below the conjunctiva.

In the eyelid the *Loa* is apt to give rise to a slight tumefaction at least, and this may simulate entirely different conditions. Thus in the case recorded by Dr. Thompstone (No. 36) the parasite lay in the lower lid at the inner canthus close to the lachrymal sac, the swelling in that region giving the appearance of dachryocystitis. When an effort was made to press out the contents of the sac, the worm wriggled away.

*F. loa* may migrate from point to point under the skin without producing any visible effect upon the parts invaded. Thus in different cases it has been watched in its migrations from the eye to the forehead, or over the bridge of the nose to the other eye or under the skin of the back or chest; and in all of these it is not recorded that any modification of the normal appearance of the part followed the movements of the worm. One of the most distinct and trustworthy of these observations is that quoted from Starr in the present paper (p. 6).

## CALABAR SWELLINGS

The first publications I have found on the nature of Calabar swellings (the Kamerungeschwülste of the German authors) are in the book by Plehn (1898) and a contribution exclusively on this topic by Thompstone (1899), a district medical officer in Old Calabar. To be sure they were recognized as a distinct disease much earlier, and are referred to under this name by Robertson (1895). Since then numerous references have been made to their occurrence, and several observers have discussed at length their character and cause. They are apparently spontaneous and fugitive in character, appearing suddenly and requiring two to three days to disappear. In size half that of a goose egg, they may occur on any portion of the body, though according to most they apparently favor the extremities. They are painless and do not pit under pressure. According to Thompstone they come one at a time and recur at irregular intervals of time. He also states they are somewhat hot both objectively and subjectively, while Joseph (1903) states distinctly that they are accompanied by no temperature.

Robertson (1895), was apparently the first to call attention to the fact that his patient, afflicted with *F. loa,* also suffered from Calabar swellings. Later observations on the same patient (Robertson, 1897) record an immediate recurrence of the trouble on return to Old Calabar, where itching behind the eyes and swellings on the arms are almost universal among the natives. He also says that when the parasites are felt moving, headache and nausea as well as puffy swellings of the arms are troublesome, while all parts of the body may be affected, especially the scalp.

In regard to the cause of these swellings, Manson (1903) sums up the case well when he says, "Their peculiar geographic range, which it would seem includes the Congo basin, the fact that they come and go, the fact that they persist in recurring after the subject has left the endemic districts, render it practically certain that they are of parasitic origin." In the same paper he reports a series of eight cases of the disease among missionaries on the Upper Congo, two of which had been under his personal care. He further notes the general association with *F. loa,* and conjectures they may be due to the parturition of this species. Their association with *F. loa* and possible relation to that parasite had already been commented on by Robertson. The absence of *F. diurna,* the conjectured embryonic form of *F. loa,* as shown apparently by his blood tests, may easily be due to failure to make preparations at the proper time or place. Furthermore, the geographic distribution of this malady is much the same as that of *F. loa,* which would further strengthen the view that there exists a causal relation between the two.

More recent publications have brought forward additional proof of this causal relation. Thus Habershon (1904) has presented strong evidence in favor of the view, when he reports that almost every European at Yakusu suffers, and adds details of several cases which were under careful continuous observation and showed the presence also of *F. loa.* In one case the attack commenced with the most intense neuralgic pain, followed by swelling of the part affected, which began a few hours later and was comparable to an attack of acute myositis. Kerr (1904) also adds evidence on the relation between *F. loa* and the Calabar

swellings in a series of four cases. Apparently Ziemann (1905) has been able to demonstrate the embryos in the swellings, as he explains the difficulties attendant upon the demonstration. He seems to think, however, that these swellings are due to *F. perstans,* which in his opinion is the embryonic *F. loa,* while *F. diurna* does not differ from *F. Bancrofti.* He is in accord with previous authors in holding that *F. loa* remains mostly hidden in its wanderings, but causes inflammation in the subdermal connective tissue. Wurtz et Clerc (1905) found in their case of infection with *F. loa* that a tumefaction was produced on the right cheek when the parasite was wandering about in the region of the eye. They also added the important observation that a pronounced intense eosinophilia was associated with the presence of *F. loa* in the system. It should be noted that the general symptoms of this case point unmistakably to the presence of a number of parasites and the extreme character of the eosinophilia noted was perhaps due to the multiple infection.

The view that in some way Calabar swellings are related etiologically to the parasitism of *F. loa* rests thus on strong presumptive evidence, and it is timely to consider the theories which have been offered to explain the pathological conditions noted. It is clear, without further discussion, that the mere presence of the parasite as of a foreign body of equal size would not be sufficient to evoke the swellings. It is equally evident that the constant limitation of the worm to the connective tissue, especially in the subdermal region, would throw out of consideration the introduction even occasionally of foreign matter of any sort and limit the problem clearly to the parasite itself and its own activities and products, working upon the normal tissues with which it comes in contact.

The earliest suggestion made was that of Robertson that to the migrations of the *Loa* are due these swellings which are associates with its presence. Careful study of the data recorded in connection with the various cases seems to show, however, that mere movement can not be the exciting cause. Note first that the swellings are local and infrequent; now mere migrations, if effective, ought to produce linear tumefactions conforming to

the path the worm has followed, if not immediately coincident in time with its movements. There is one record of such movement of the swelling, given by Milroy in the present paper (p. 47), but another similar observation has not been noted, and there is much indirect evidence to show that it does not occur ordinarily at least. In fact, these swellings are usually described as oval, circumscribed, and of relatively small size; hence the stimulating factor must be a variable or occasional one. Furthermore, the swellings are single or rare, while it is indisputable that the migrations of the worm are constant and considerable. Its activity and freedom of movement have been commented upon by many observers, and are manifest both in the eye and elsewhere in the body. This striking contrast between the pathological conditions and the parasite supposed on good grounds to produce them can only be explained by the assumption that the exciting factor is an intermittent element in the biology of the parasite, of relatively infrequent occurrence. In further support of the view that the pathological condition is not the result of the mere movements of the parasite may be urged the record of observations concerning its movements under the conjunctiva. The unanimous testimony of observers is that the parasite produces no change whatever in the appearance of the organ, as it moves across the surface of the eyeball, nor is any alteration visible subsequently save an insignificant elevation of the surface. Similarly, it has been seen moving under the skin in other parts of the body without pathological changes resulting. Important additions to the previous records on this point are found in the observations of Friend, Starr, and Loveland included in the preceding pages.

Manson reports the statement of one of his patients that the erythema and swelling are due to mechanical excitation when the region of the parasite is rubbed. Indeed, this lady, long resident in Old Calabar, informed him that if rubbing or scratching is not indulged in when a *Loa* approaches the surface there will be no swelling. It is difficult to see how the rubbing could produce such definite areas or how the number and frequence of the swellings could be so limited. Furthermore, Milroy records the

evidence of his patient that such a swelling may be rubbed *to remove it,* so that the evidence is at least somewhat confused.

It can hardly be that the parasite in its migrations stimulates nerve fibers or endings and thus produces as secondary results the conditions; for any excitation of sensory elements is inadmissible, as the swellings are distinctly declared by most authors to be painless. Hence Blanchard's suggestion of similarity to the symptoms evoked by *Hypoderma lineata,* a fly larva that carries out subcutaneous migrations, hardly meets the conditions of the case. Looss (1905) calls attention to a more striking parallel between the Calabar swellings and those seen at times in cases of *Sparganum Mansoni,* a migrating cestode larva which occurs in the East.

Hardly more acceptable as an explanation of Calabar swellings is the view that the *Loa* in its movements stimulates unduly reflex or sympathetic fibers. The infrequence of the swellings and their distribution as compared with the nervous elements speak distinctly against the supposed relation.

Convinced of the insufficiency of previous efforts to explain the tumefactions, Manson (1903) advanced the view that they are caused by the discharge of embryos into the tissues. This discharge of embryos from the parental form is intermittent, and would produce the swellings by acting as a mild irritant and causing a transient edema. In most respects this view meets the conditions thoroughly, and it can hardly be said that definite facts are recorded as yet which it fails to explain. Yet its acceptance involves distinctly the concession that not all cases of infection with *F. loa* are subject to Calabar swellings; for when the host harbors the male parasite alone, or also only immature females, there can be no discharge of embryos into the tissues and consequently no swellings produced. The theory of Manson conforms to the facts in so far that cases of *F. loa* are on record and are also distinctly noted by physicians (Ziemann, 1905) in the infected region in which Calabar swellings do not occur. On the other hand, there are cases in which the swellings are found at such an early period after the coming of the host into infected territory that the *Loa* could not have

reached sexual maturity. As already emphasized, all the evidence points to an extremely slow growth of the parasite and to conformable delay in reaching sexual maturity. Unless this evidence has been entirely misconstrued, and a more rapid attainment of sexual maturity is possible under some undetermined circumstances, the view of Manson fails to account completely for the facts in the case. In the case of Milroy the swellings began within two years from the time of entrance into the infected region; furthermore, the parasite extracted three years later was a male, and so far as known only a single parasite has been present in the body of this patient.

In view of these facts I venture to suggest another feature which may not be without its bearing on the production of these swellings. The parasite will, from time to time, discharge from its body waste materials which in their very nature are toxic and hence likely to cause such local changes as the Calabar swellings. The action in this case would be chemical rather than the mechanical irritation from the discharge of embryos. The ultimate decision in this matter must necessarily await the accumulation of further evidence. So far as facts at present on record are concerned none of the causes advanced thus far are sufficient to explain the rarity of the tumefactions in cases of multiple infection by the parasite.

## 5. Clinical Data

### CLINICAL NOTES ON CASES 53 AND 54

BY W. F. MILROY, M.D., OMAHA

Batanga is a settlement situated in German territory, on the western coast of Africa in about 3° north latitude. In 1897 Mr. K., an American of German parentage, became a resident of this place. About two years later he first observed upon his body a tumefaction which, in that country, is known to foreigners as "the African swelling," and which is by common consent attributed to a parasite. To the natives this parasite is known as the eye worm because of a disposition it exhibits to frequent the neighborhood of that organ.

That the swelling is caused by this parasite seems not to be a fact absolutely established. However, upon one occasion within the knowledge of Mr. K:, one of these upon the dorsal surface of a woman's hand, being rubbed with a view to removing it, the parasite was seen to emerge from the tumefaction and make its way across the metacarpo-phalangeal articulation, from which location it was extracted. Upon another occasion the swelling appeared, upon his own person, over the right frontal eminence. Within an hour it had extended downwards across the supra-orbital arch, along the right side of the nose, and outward beneath the eye as far as the outer limit of the orbit. During this process, when the swelling reached the side of the nose, the movements of the parasite became visible beneath the skin and upon the surface of the tumefaction, where it was seen to cross below the eye, and the sharp, stinging sensation was apparent to its host as it made its way downward across his cheek. From these and similar observations there would appear to be little room to question the correctness of the assumption that the occurrence of this swelling is conclusive evidence of the presence of the parasite.

The swelling is from three to five or eight centimeters in diameter and not greatly elevated. The appearance of its cutaneous covering remains normal. A sharp stinging or smarting sensation with more or less itching attracts attention where the swelling is about to appear. The swelling is indurated and is sometimes accompanied by great pain, but in other cases pain is absent. From its first appearance until the part returns to its normal condition a period of two or three days elapses. It occurs upon the head or face, the wrists, hands or fingers, the ankles, feet or toes. It is seldom seen upon other parts of the body. This may be accounted for by the relative deficiency of subcutaneous connective tissue in the parts mentioned. When the joints of the extremities are involved, marked stiffness and pain are felt on motion, and in some instances creaking of the joint so marked as to sometimes be audible at a distance. No distinction of age, sex, or condition exists as to susceptibility to invasion of this parasite. The host is never aware of its presence

except when it approaches the surface of the body, and no constitutional symptom is recognized as due to its presence. So far as known to Mr. K. no permanent harm has ever resulted from its occupation of the human body.

In February, 1902, Mr. K. came to me for the removal of his "eye worm" which had made its appearance beneath the cutaneous surface of the upper lid of his right eye. Its movements were readily visible. A fold of the skin was firmly seized with a forceps so as to include the moving body, an incision was made near the forceps and after a search of fifteen or twenty minutes a portion of the parasite appeared in the wound; this was seized and the animal extracted. Since the first appearance of the parasite in his body in 1899, it had shown itself at points as remote as the sole of the foot and the face. He sometimes was unaware of its presence for two or three months continuously, but it was usually manifest at much shorter intervals. Previously unsuccessful efforts had been made to remove it from the inner side of his left arm, below the nipple on the left side, and near the lower angle of the left scapula. As a rule, having appeared at an accessible point it was gone before a surgeon could be reached. Mr. K. stated that he had experienced no inconvenience from the presence of his tenant except when it approached the surface of his body where it usually remained but a very short time. On one occasion it gave rise to violent pain as it made its way across the sclerotica below the iris of the right eye.

Since the extraction of this specimen four months have elapsed with no recurrence of the symptoms. Whether more than a single specimen has ever existed in the body of this gentlemen he does not know, but during the period of about three years, from the first sign of its presence until the extraction of the parasite in February last, the characteristic manifestations have never appeared simultaneously at more than one point.

### OBSERVATIONS OF LOTA

To these notes of the case of Milroy it is valuable to append another little-known record quoted by Terrin. It is an interesting account which gives the following clinical picture of *F. loa*

and comes from the observation of a French physician, Lota, who had opportunity to study the action of the worm in his own eye.

After his stay in Gaboon and return to France, Lota suffered oft-recurring conjunctivitis with which he was not previously afflicted. Suddenly he felt in the right eye a sting without outward cause, and a feeling of heaviness which was unpleasant, while at the same time there arose an active injection of the conjunctiva bulbi. These symptoms disappeared on application of cold lotions to the eye, but recurred in a few days. Lota attached no importance to the matter. Five months after his return he was awakened from sleep one morning by a sharp pain in the right eye. He had the sensation of a foreign body under the upper lid, accompanied by frequent winking. As he drew up the upper lid before a mirror, he noticed the conjunctiva was reddened, swollen, and slightly elevated. He recognized under it a yellow irregular mass without being able to determine its nature. The sensation of a foreign body lasted about two hours and then ceased suddenly. Lota investigated the eye again and could determine only a slight conjunctivitis; the yellow body was gone!

That evening the same symptoms came on again. Lota noted on the sclera a yellow, round body of the caliber of a knitting needle, about 2 to 3 cm. long, which moved itself from the external angle of the eye towards the caruncle, at times straight, again bending itself into U and S shapes; it crept along under the corium above the sclera only to disappear at the inner angle of the eye. Next evening the worm showed itself under similar circumstances below the conjunctiva above the cornea; here it remained a long time so that several colleagues of Lota could observe its presence and movements. It then disappeared again into the depth of the eye and never appeared thereafter. Its presence had induced no further change on the bulb than an insignificant elevation of the connective tissue. The visual power was never disturbed.

### 6. Critical Bibliography of *Filaria loa*

The accompanying bibliography includes all references to *Filaria loa* and also all which at any time, so far as I have been

able to ascertain, have been construed as such, together with the publications which have contributed to the explanation of any doubtful cases. No attempt has been made to include all references to human eye worms other than *F. loa,* although the involved condition of this subject has resulted in bringing together here the majority of these also. The list includes only the more prominent text-books, or such as contain extended discussions or original contributions to a knowledge of this species. For valuable assistance and criticism in the preparation of this bibliography I am indebted to Professor J. I. Wyer, librarian of the University of Nebraska.

In printing these references the two numbers separated by a colon denote volume and page, i. e. 28:510 means volume 28, page 510. An additional number in parentheses before the two just explained denotes the series and is used only when the volumes of each series are numbered separately from those of preceding series.

## Bibliography

Addario, C.

1885. Su di un nematode dell'occhio umano. Ann. d. ottalm., 14:135–48, 1 pl.

This much-cited paper deals with another species, *F. conjunctivae,* identical with the form described later by Grassi as *F. inermis,* a normal parasite of horse and ass, and an occasional one in man. It is entirely distinct from *F. loa.*

Annett, H. E., Dutton, J. E., and Elliott, J. H.

1901. Report of the Liverpool Expedition to Nigeria. Part II. Filariasis. Thompson Yates Laboratory Reports, 4:1–93, 14 pl.

Found *F. diurna* in a boy of lower Nigeria who was also infected with *F. loa.* Second case of *F. loa* without embryos in blood. Relation of *F. diurna* and *F. Bancrofti* discussed at length; weight of evidence favors identity.

Arrachart, J. N.

1805. Mémoires, dissertations et observations de chirurgie. Paris, 8°, 302 pp.

Mémoire sur les vers des yeux. Lu à l'Academie de chirurgie en 1778; (p. 217) records the cases in St. Domingo known to him and asserts that the *Loa* is a valid species distinct from the Guinea worm. Reproduces Bajon, 1777, and Guyot, 1805.

ASSENOVA, SABA.

1899. Étude sur la provenance des entozoaires superficiels. Thèse. Fac. med. univ. Nancy, No. 6.

Cites *verbatim* the case of Lota as Obs. XXII, briefly that of Robertson as Obs. XXIII, and notes in text few other cases without details.

BACHELOR, H. M.

1880. The Eye Parasite, *Dracunculus loa.* (Letter to the editor from Gaboon, W. Coast of Africa. Dec. 15, 1879.) Med. Record, N. Y., 17:244.

Specimen extracted from native young man. The first perfect specimen sent to U. S. A.

1881. *Filaria loa* and *Pulex penetrans.* Med. Record, N. Y., 19:470–71.

Case in white woman, missionary; three worms removed. Dr. Nassau (cf. Morton, 1877) "had one in the areolar tissue between the thumb and index finger."

1881a. *Filaria loa* and *Pulex penetrans.* (Trans. IV.=) Bull. N. Y. Path. Socy., (2) 1:108–11.

Identical reprint of Bachelor, H. M., 1881.

BAJON, M.

1777. Mémoire pour servir à l'histoire de Cayenne et de la Guyane françoise. Paris, 2 vols., 8°. Abstr. in Jour. de méd., (1778) 49:386–408, 481–97.

Two cases (1:325) in negroes at Cayenne, in 1768 and 1771. Quoted verbatim by Blanchard (1899) under date of 1778. Also in Arrachart, 1805:217.

1781. Abhandlungen von den Krankheiten auf der Insel Cayenne und der französischen Guyana. Erfurt. Bd. I, II.

Not found. Cited after Kraemer (1899). Probably translation of Bajon, 1777.

BARKAN, A.

1876. A case of *Filaria medinensis* in the Anterior Chamber. Arch. Ophth. and Otol., N. Y., 5:151–52.

Filamentous object adherent to iris was removed from native Australian and found on microscopic examination to be *"F. medinensis."* Can hardly be *F. loa,* but the absence of data leaves it permanently uncertain. Perhaps an Australian filaria.

1876a. Ein Fall von Filaria in der vorderen Augenkammer. Archiv. f. Augenheilk., 2:381–82.

Literal translation of Barkan, 1876.

BARRETT, J. W.

1896. A case of *Filaria oculi humani.* Archives of Ophthalm., N. Y., 25:291–92.

Worm removed in 1893 from eye of white male who had lived on Gold Coast and had come to Melbourne four years before. Identification probable. First case in Australia.

1897. Ein Fall von Filaria im menschlichen Auge. Arch. Augenheilk., 34:255. Cf. CB. Bakt. u. Par., 22:419.

Literal translation of Barrett, 1896.

BERNARD, P.

1898. Un cas de *Filaria loa* mâle. Archives d'ophtalmologie, Paris, 18:604–6. Abst. in Jour. Trop. Med., 1:110–11.

Removed from white male who had lived in Congo (1894–96). First seen about three years before removal. Identified by Blanchard; second case, first male, of *F. loa* seen in France.

BLANCHARD, R.

1885–88. Traité de zoologie médicale. Paris, 2 vols. 8°.

Exact account with full references to cases of *F. loa* (2:10–12).

1886. La Filaire sous-conjonctivale (*Filaria loa* Guyot). Le Progrès médical, Paris, (2) 4:591–93, 611–12. Also in Rev. clin. d'oculist., No. VII, p. 159 (after Kraemer, 1899:85).

Fine record of earlier cases with discussion of structure, life history, and relation to eye worms of other animals. Presence in American hemisphere attributed to slave trade.

1899. Nouveau cas de *Filaria loa.* Arch. Parasitol., Paris, 2:504–34, 12 figs., Rev. in CB. Bakt. u. Par., 28:457; Zool. Centr., 7:243–44.

Complete discussion of twenty-five old and one new case with full illustrations of structure and data on life history and distribution. Good bibliography.

BRAUN, M.

1902. Die tierischen Parasiten des Menschen. Dritte Aufl. Würzburg, 8°, 360 pp., 272 figs. [Title page date 1903; received here in Dec., 1902.]

*F. loa* (p. 271); brief, accurate.

BRUMPT, E.

1904. La *Filaria loa,* Guyot, est la forme adulte de la Microfilaire désignée sous le nom de *Filaria diurna* Manson. CR. Soc. Biol., Paris, 56:630–32.

In an autopsy on the Congo, *F. diurna* was found in the blood, also a fragment of an adult female filaria in the heart; the latter agreed in all details with *F. loa,* but the absence of head and tail made a final determination impossible. The author regards *F. loa* as an accidental parasite of the eye.

CHIRALT, V.

1880. Sobre un caso di filaria oculi. Att. session congress reg. cien. med. 1879, Cadiz. Cron. oftal., Cadiz, (1880–81) 10:473–80.

Not seen; cited by Kraemer, 1899:85. Probably identical with following reference.

1882. Sobra un caso filaria oculi. Cadiz, Att. session congress reg. cien. med. [of 1879], pp. 2–9, 1 fig.

Not seen; cited by Coppez, 1894:567, as Filaria in vitreous body, p. 473.

CLEMOW, F. G.

1903. The Geography of Disease. Camb. Geog. Series; 624 pp., maps.

*F. loa* (p. 609) only on W. Coast Africa, endemic from a few degrees N. L. to about 10° S. L. Not in America since cessation of slave trade.

CLOT-BEY.

1832. Dragonneau. Revue générale Académie royale des sciences. Séance du 10 décembre. Archives générales de médecine, Paris, 10me année, 30:573.

Gervais et van Beneden (1859), Davaine (1877), and Rayer (1843) cite the reference as given. I have compared the original and the citation is absolutely correct; there is no hint in the abstract of any other author. The brief description records an observation by the author of a worm in the orbit and crossing the cornea of a slave girl in Monpox, brought from Africa some years before. Yet according to Guyon (1838) Clot-Bey says he has never been in America, and Leuckart (1881), together with later authors, declares the *citation* incorrect, and all attribute the case to Roulin, by what authority I have been unable to ascertain. It does not help the case to read in Guyot (1838) "Als *ich* mich im Jahr 1828 zu Monpox am Magdalenenflusse in Neugranada befand, führte mich ein dort ansässiger französischer Apotheker zu einer 25 bis 30 Jahr alten Negerin der schon erwachsen aus Afrika herüber transportirt worden war," etc.

COBBOLD, T. S.

1864. Entozoa. An Introduction to the Study of Helminthology. London, 8°, 480 pp., 21 pl., and 82 text figs.

Brief account under *Dracunculus loa* (p. 388). Defends its specific distinctness. Cites Davaine (1877) for further details.

1879. Parasites. London, 8°, 508 pp., 85 text figs.

Transfers species back to genus *Filaria* (p. 205). Otherwise as before. Short bibliography.

COOK, A. R.

1901. Notes on the Diseases met with in Uganda, Central Africa. Jour. Trop. Med., 4:175–78.

Records (p. 178) the occurrence of two cases of *Filaria diurna* in this region.

COPPEZ, H.

1894. Un cas de Filaire dans la chambre antérieure d'un oeil humain. Archives d'ophtalm., 14:557–62. Also in Clinique, Bruxelles, 1894, 8:481–84.

An infant negress from the Congo, worm in anterior chamber; immature.

1895. Progress of Ophthalmology. Arch. of Ophthal., N. Y., 24:284.

Review of Coppez, 1894.

CUNIER, Fl.

1843. As editor reprinted Nordmann, 1843, and Rayer, 1843, with comments, etc. Ann. d'oculist., Bruxelles, 9:136–77.

DAVAINE, C.

1860. Traité des Entozoaires et des maladies vermineuses de l'homme et des animaux domestiques. Paris, 8°, xix+xcii+838 pp., 37+31 figs.

Full data on earlier cases.

1877. Idem, Paris, II. ed., cxxxii+1003 pp., 72+38 text figs.

Apparently identical reprint (pp. cvii+839) of earlier edition as regards this species.

DE METS, —.

1896. Une observation de filaire de la retine. Belgique Méd., Gand-Haarlem, 1:737–42. Abst. in Ann. Ophth. & Otol., N. Y., 5:1097.

Nematodes in urine; not precisely described or identified. Not *F. loa.* Presence in retina inferred.

DIESING, C. M.

1851. Systema Helminthum. Bd. II. Vindobonae.

Under *F. medinensis* (p. 270): "Habitaculum, homo. . . . rarissime sub conjunctiva oculi (Bajon, Mongin, et Blott)."

1861. Revision der Nematoden. S. B. math-natw. Kl., Akad. Wiss., Wien, 42, Nr. 28.

Lists *F. loa* as *Dracunculus oculi* (p. 697).

DRAKE, BROCKMAN.

1894. [Notes.] Ophth. Rev. (London), 13:331. Also in Ophth. Socy.—Brit. Med. Journ., 1894, 2:921.

In eye of young woman in Madras, India; worm escaped from puncture and not studied. Blanchard (1899) thinks this is more probably *F. equina,* common in India.

1894a. Cas de Filaria loa sous-conjonctivale. Annales d'oculist., 112:336.

Translation of Drake, 1894.

DUJARDIN, F.

1845. Histoire naturelle des helminthes ou vers intestinaux. Paris, 8°, avec un atlas de 12 pl.

Notes (p. 46) the occurrence in the human eye of a Filaria not yet described, which is certainly different from *F. medinensis.*

DUYSE, —, VON.

1895. Un cas de Filaire dans la chambre antérieure d'un oeil humain. Archives d'ophtalm., Paris, 15:701–6.

Same case as Coppez (1894), Gauthier (1895), and Lacompte (1894); worm extracted by latter. Discussion of species and records.

EVERSBUSCH, [O.]

1891. Entozoen im Glaskörper (Mittelfränkischer Aerztetag in Fürth). Münchener med. Wochenschr., 38:532. Also in Jahresb. d. Leist. u. Fortschr. d. Ophth., 22:305.

1892. Glaskörperentozoen. Ber. über d. xxi. Versammlung d. Ophth. Ges. Heidelberg, 1891:249. Ausserordentliches Beilageheft zu Klin. Monatsblätter f. Augenheilkunde, 29.

Preliminary report on supposed living worm observed by eye mirror. Extended description not published as promised. Certainly not *F. loa.* Probably persistent hyaloid artery.

FANO, [S.].

1868. Observation de filaire vivante du corps vitré. Union méd., Paris, (3) 5:389–91.

Observed by eye mirror in child of twelve years; not removed.

1868a. Filaire vivante dans le corps vitré. Annales d'oculist., 59:207–8.

Literal reprint of Fano, 1868.

1876. Filaire vivante du corps vitré. Modifications survenues dans l'oeil malade huit ans apres le premier examen. Jour. d'oculist., Paris, 42:172–74.

Examination of case of 1868 after eight years. Original text reproduced. Further observations unimportant. Not *F. loa.*

GAUTHIER, C.

1905. Microfilaires du sang coincidant avec une filaire de l'oeil. CR. Soc. Biol., Paris, 58:632–34.

In a patient who had had a filaria in the eyelid were found later embryos like Manson's *F. diurna* but smaller than Brumpt's measurements of the embryos of *F. loa.*

GAUTHIER, G.

1895. *Filaria oculi humani.* Annal. de l'Inst. chir. Bruxelles. Chap. Ophtalm., p. 15.

Not found; probably the same as the following entry.

1895a. Filaire de l'oeil humain. (Annal. de l'institut chir. de Bruxelles, 1895.) Ann. d'oculist., 114:152–53.

Only a short review by Dastot. Young Congo girl; worm moved rapidly through anterior chamber; not extracted; probably *F. loa.* According to Blanchard (1899) same case as Coppez (1894).

GERVAIS, P., ET VAN BENEDEN, P. J.

1859. Zoologie médicale. Paris. J. B. Baillière et Fils. 8°, 2 vols., 198 text figs.

Case communicated by French marine surgeon, Lestrille, from Gaboon, 1854, given in full (p. 143). Older cases quoted.

GESCHIEDT, A.

1833. Die Entozoen des Auges, eine naturhistorische, ophthalmologische Skizze. Zeit. f. Ophthal., Dresden, 3:405–62.

An oft cited reference which concerns a small nematode otherwise unknown (cf. Nordmann, 1832), and certainly not *F. loa.* Discussion of eye parasites in other animals.

GRASSI, B.

1887. *Filaria inermis* (mihi) ein Parasit des Menschen, des Pferdes, und des Esels. CB. Bakt. u. Par., 1:617–73.

Extended description of *F. conjunctivae,* Addario, 1885, (q.v.) and of the cases of this species sometimes confused with *F. loa.*

GUYON, [J. L. G.].

1838. Note sur des vers observés entre la sclérotique et la conjonctive, chez une négresse de Guinie, habitant la Martinique. CR. Acad. Sci., Paris, 7:755–56. (Cf. Guyot, 1838.)

Case of Blot who extracted two *F. loa* from a young negress of Martinique that had come from the African Coast. The worms were sent Guyon.

1841. Note sur un ver trouvé dans le tissu cellulaire sous-conjonctival. Gaz. méd. de Paris, 9:106.

Corrects an erroneous reference to the preceding case as due to cysticerci, and quotes Blot as reporting the patient perfectly well to date.

1864. Sur un nouveau cas de filaire sous-conjonctival, ou *Filaria oculi* des auteurs observé au Gabon (côte occidental d'Afrique). CR. Acad. Sci., Paris, 59:743–48.

One specimen taken from a negro of Gaboon, Africa, and extended reference to six previous cases, all from America. Gives as the first evidence of the occurrence of *F. loa* a plate printed in Frankfort (Germany) in 1598. This much-cited illustration is shown by Ward (1905) to be fanciful.

1864a. Sur un nouveau cas de filaire sous-conjonctival ou *Filaria oculi* des auteurs, observé au Gabon (côte occidental d'Afrique). Annales d'oculist., 52:241–45.

Reprint of Guyon, 1864.

GUYOT, — —.

1805. In Arrachart, 1805. Copied by Rayer (1843) as Obs. IX.

French naval surgeon records six cases in 1777 from African Coast. Extraction attempted and failed.

GUYOT, — —.

1838. Ueber Würmer welche sich unter der, den vorderen Theil des menschlichen Auges bedeckenden, Schleimhaut aufhalten. Froriep's Neue Notizen, 8:230–31.

Cites earlier cases, notes as new that of Blot who sent one specimen to Blainville. This paper is that referred to under Clot-Bey, 1832. This apparently should be *Guyon*, 1838, with which it agrees, though the German translator has printed consistently *Guyot*. This same error has been made more recently by Scheube, 1900.

HABERSHON, S. H.

1904. Calabar Swellings on the Upper Congo. [Includes letter from D. Argyll Robertson.] Jour. Trop. Med., 7:3–4.

Almost every European at Yakusu suffered. Clinical data. Several cases of *Loa* briefly noted. Letter gives further history of Robertson's patient, including extraction of parasites not in eye.

HARRISON, J. H. H.

1904. *Filaria loa* (?). Selected Colon. M. Repts., 1901–2, London, p. 46.

Not seen. Cited from Index Medicus.

HENRY, F. P.

1896. Remarks on *Filaria*. Proc. Acad. Nat. Sci., Phila., 1896: 271–75. Rev. in Zool. Jahresb., 1896, Vermes, p. 44.

Cites cases and data from Manson and Robertson; rejects Manson's view that *F. loa* is adult of the embryonic blood worm known as *F. diurna*.

HIRSCHBERG, J.

1895. Ueber einen aus dem menschlichen Augapfel entfernten Fadenwurm. Berliner klin. Wochenschr., 32:956–58, 971. Rev. in Zool. Centr., 3:233; CB. Bakt. u. Par., 18:755. Also 1896, Verh. Berlin. med. Ges., 26, pt. 2:287–94; Centralb. prakt. Augenheilk., 20:27–32, 4 figs.

Female *F. loa* taken from eye of negro in Cayo, French Congo. Review of earlier cases.

HUBER, J. CH.

1898. Bibliographie der klinischen Helminthologie. Supplementheft. Inhalt: Filaria (excl. F. sanguinis hominis), Strongylus, Gnathostoma, Strongyloides, Rhabditis, Pentastomum. Jena, 22 pp.

*F. loa* (pp. 3–5); doubtful cases (p. 6). References arranged by countries, brief annotations.

JOSEPH, E.

1903. Medizinische Mittheilungen aus unseren westafrikanischen Kolonieen. Dtsch. med. Woch., 29:145.

Describes Kamerun swellings as occurring anywhere, but especially on extremities. Not painful, no temperature, cure spontaneous in few days.

KERR, T. S.

1904. Calabar Swelling and its Relationship to *Filaria loa* and *diurna*. Jour. Trop. Med., 7:195–96.

Cites theories of Manson and Robertson regarding Calabar swellings. Records cases of Habershon, Wurtz, and Hanley. Thinks this evidence demonstrates relation of *F. loa* and its embryonic form *F. diurna* to the trouble.

1905. [Abstract.] Arch. f. Schiffs u. Tropen-Hyg., 9:181.

1905a. Kalabarbeulen und ihre Beziehungen zu *Filaria loa* und *diurna*. Münch. med. Wochenschr., 52:474.

Review of Kerr, T. S., 1904.

KINGSLEY, MARY H.

1897. Travels in West Africa, Congo Français, Corisco, and Cameroons. Macmillan & Co., London, 8°.

Under diseases the author notes "lastly, a peculiar abomination, a filaria. . . . I have seen the eyes of natives simply swarming with these filariae. . . . A similar but not identical worm is fairly common on the Ogowé and is liable to get under the epidermis of any part of the body."

KRAEMER, A.

1899. Die tierischen Schmarotzer des Auges. IV. Die Fadenwürmer (Filariae) des Auges. Gräfe-Samisch Handbuch, II Theil, X Band, 10 und 11 Lief., xviii Kapitel: 64–87, figs. 7–9, 182 pp., 17 figs. Rev. CB. Bakt. u. Par., 28:517–18.

Full record of earlier cases with unfortunate misprints in names and dates; includes under *F. loa* doubtful cases and also Addario, determined by Grassi as *F. inermis*. Says *F. loa* occurs in eyelids and fingers, though Morton, the authority cited, only gives this as the opinion of Nassau; believes *F. loa* and also the Guinea worm may wander back into tissue of orbit.

KUHNT, H.

1888. Extraction eines Fadenwurms (Filaria) aus der Regio macularis des menschlichen Glaskörpers. Corr. Bl. allg. ärztl. Ver. Thüringen, 17:541–55.

Original not seen. Cited thus by Kraemer, 1899.

1892. Extraction eines neuen Entozoon aus dem Glaskörper des Menschen. Archiv. f. Augenheilk., 24:205–29. 2 figs.

Peculiar small nematode, not identified by Leuckart, not *F. loa*. Removed by operation from the vitreous body.

LACOMPTE, C.

1894. Observation d'une *Filaria oculi* dans la chambre antérieure de l'oeil d'une Congolaise; extraction de l'entozoaire. Annales soc. méd. de Gand, 73:375–86.

Observation brief (pp. 375–77); report on same (pp. 378–86) identical with Van Duyse (1895) who is also named here as on the commission.

LALLEMANT, [L.].

1844. Filaria im Auge eines Negers. Casper's Wochenschr. f. d. ges. Heilkunde, 1844:842.

From negro in Rio Janeiro, broke in removal, case regarded as unique, but assigned to Guinea worm.

LARREY, D. J.

1812. Mémoires de chirurgie militaire et campagnes. Paris, 4 vols. (1812, 1812, 1812, 1817).

Cites de Lassus (1:223) on *Filaria loa*. Copied verbatim by Blanchard, 1899.

LASSUS, —, DE.

Reported by Larrey (1812:223, q.v.).

LEIDY, Jos.

1877. See Morton, T. G., 1877.

LESTRILLE, — —.

Reported by Gervais et van Beneden (1859:143, q.v.).

LEUCKART, R.

1863–76. Die menschlichen Parasiten, etc. 2 v. 8°. Leipzig.

*F. loa* (2:619–22). Full analysis of older cases.

1881. Bericht über die wissenschaftlichen Leistungen in der Naturgeschichte der niederen Thiere während der Jahre 1876–79. Arch. f. Naturges., 1877, 2:397.

Cites Morton (1877), adds case from European on Loango Coast, examined worm and pronounced *F. loa* a good species. Though bearing the date of 1877 and usually quoted as such, this article includes data up to 1879. It was received by the Harvard Library in Dec., 1881. I adopt this year as the date of the paper.

LINSCHOTEN, JAN HUYGHEN VAN.

1596. Itinerario. Voyage ofte Schipvaert von Jan Huygen van Linschoten naer Oost ofte Portugaels Indien, etc. t'Amstelredam. Cornelis Claesz, 4°.

This work, of which only three editions are noted here, is often incorrectly cited as giving evidence of the occurrence of *F. loa* in Africa in 1598. (Cf. Ward, 1905.) This, the original edition, has not the plate supposed to illustrate the extraction of *F. loa.*

1610. Histoire de la Navigation de Iean-Hugues de Linscot Hollandois et de son Voyage es Indes Orientales, etc. Amstelredam, Theodore Pierre, 4°.

This later reprint possesses the plate in question.

1885. The voyage of . . . to the East Indies. From the Old English translation of 1598. The First Book. Edited. In 2 vols. Hakluyt Society, London. (Reprint of edition of 1598.)

The footnotes of this reprint (pp. 46, 52) disclose clearly the fictitious character of the plate in question.

LINSTOW, O. VON.

1900. Ueber die Arten der Blutfilarien des Menschen. Zool. Anz., 23:76–84.

Discusses briefly the form *Filaria diurna* Manson and the view that this is the larva of *F. loa.*

LONEY, W.

1844. Extirpation of Dracunculi from the eye. Lancet, London, 1:309.

English marine surgeon removed *F. loa* from two natives of West Coast of Africa. Description scanty.

LOOSS, A.

1904. Zur Kenntniss des Baues der *Filaria loa* Guyot. Zool. Jahrb., Abt. Syst., 20:549–74. 1 pl.

Extended and admirable account of the anatomy with careful references to earlier work on this phase.

1905. Von Würmern und Arthropoden hervorgerufene Erkrankungen. Handbuch der Tropenkrankheiten, herausgegeben von Dr. C. Mense. 1:77–209, 54 text figs, pls. 8, 9.

*F. diurna*, p. 167; *F. loa*, pp. 177–79. Brief but very complete and correct review of anatomy, life history, and pathology so far as known, including account of Calabar swellings which are likened to those produced by *Sparganum Mansoni*.

LOPEZ, E.

1891. Filaria en la camaria anterior. Rev. de cien. méd. Habana, 6:269.

Not found; cited after Kraemer, 1899.

LOTA, [F. L.]

1884. [Filaire sous-conjonctivale.] In Terrin, L., 1884.

Cited in full in the present paper (p. 49).

LUDWIG, H.

1896. Filaria loa. Sitz.-ber. niederrhein. Ges. f. Nat. u. Heilk., Bonn, 1896, nat-w. Sect., pp. 50–2. (Sitzung 3 Feb., 1896.)

Report of previous papers, including Ludwig & Saemisch (1895). Added data from Manson's and Robertson's cases.

LUDWIG, H., UND SAEMISCH, TH.

1895. Ueber *Filaria loa* Guyot im Auge des Menschen. Zeit. f. wiss. Zool., 60:726–40, 1 pl. Rev. in CB. Bakt. u. Par., 1 Abt., 19:424–25; Lubarsch–Ost., 3:618; Zool. Cent., 3:209–10. Schmidt's Jahrb., Bd. 251; Ann. Ophth. and Otol., N. Y., 5:1097–98.

Female specimen extracted from beneath conjunctiva of Russian marine officer whose last trip to West Coast of Africa was in 1891. Careful description of anatomy of worm.

MACNAMARA, — —.

1863. *Filaria papillosa* in the Eye of Man and the Horse. Indian Ann. Med. Sci., Calcutta.

Not seen, noted by Robertson (1894) and others. Cited after Huber (1898). The date is given 1864 by some authors.

MALGAT, [J.].

1893. Filaire ou dragonneau du corps vitré. Rec. d'ophtal., Paris, (3) 15:280–83.

Case of man in French Alps; description uncertain, probably filament or artery, certainly not *F. loa*.

MANSON, SIR PATRICK.

1891. The *Filaria sanguinis hominis major* and *minor*, two new species of Haematozoa. Lancet, London, 1891, 1:4–8, 15 figs.

Suggests that *F. loa* when in the eye has "lost its way" and its proper habitat is some part more favorable for release of the embryos into the general circulation. Queries whether the smaller form, later called *F. perstans*, might not be the larva of *F. loa*. Subsequently he assigned this role to the larger species, now called *F. diurna*.

1893. The *Filariae sanguinis hominis* and Filaria Disease. Chap. 21 in Hygiene and Diseases of Warm Climates by Andrew Davidson. Edinburg and London, pp. 738–851, figs. 51–78.

Not on *F. loa*.

1893a. Diseases of the Skin in Tropical Climates. Chap. 24 in Hygiene and Diseases of Warm Climates, by Andrew Davidson. Edinburg and London, pp. 928–95, figs. 80–97.

Record of *F. loa* (p. 961) quoted from Morton, 1877. Also case of negro with *F. loa* and later *F. diurna* in blood. Suggests relation.

1895. See Robertson, D. A. 1895b.

1898. Tropical Diseases. London, 8°.—

Two new cases noted briefly; relation of *F. loa* and *F. diurna* discussed.

1900. Tropical Diseases. London. Revised edition, 8°, 704 pp., 114 illus., 2 col. pl.

Identical in the main with earlier edition, but adds discussion on Calabar swellings.

1903. Calabar Swellings on the Upper Congo. Jour. Trop. Med., 6:347–48.

Records eight cases among missionaries, two coming under his own observation. The peculiar geographic range, transient character, irregular recurrence of these swellings, and association with *F. loa*, all point to a causal relation. Conjectures the cause as the parturition of *F. loa;* failure to find embryos due to time or incompleteness of observation.

1904. A Note on Dr. Primrose's Paper on Filariasis. Brit. Med. Jour., 1904, 2:72–73.

Upholds specific distinctness of *F. diurna* from *F. Bancrofti* as against Annett, Dutton, and Elliott. Reports occurrence of *F. diurna* in case of sleeping sickness in Paris at this time.

MAUREL, — —.

1868. Recorded as Obs. III by Trucy, 1873 (q.v.).

MITCHELL, H.

1859. Report of a Case of a Guinea Worm in the Eye. Lancet, London, 2:533–34.

Young negress taken from West Coast of Africa to Trinidad in 1834; worm first seen in 1837, again in 1841, 1845; hence at least eleven years in body; had grown from 0.5 in. to 2 in. Felt in body later, but not seen [?same worm?].

MONGIN, — —.

1770. Observation sur un Ver trouvé sous la conjonctive, à Maribarou, isle Saint Domingue. Jour. de méd., Paris, 32:338–39.

Earliest known case, negress of St. Domingo; worm extracted.

MONIEZ, R.

1896. Traité de Parasitologie. Paris, 8°, 680 pp.

Short description (p. 351), annotated list sixteen cases. Refers in footnote to Guyon's discovery of plate of 1598 showing operation for removal of eye worm. (Cf. Ward, 1905.)

MOQUIN-TANDON, A.

1859. Éléments de zoologie médicale. Paris, J. B. Baillière et Fils, 12°, 428 pp., 122 figs. [Title page date 1860. British Museum stamp date 24 De. 59. Also in printed catalogue.]

Brief account, unchanged in later editions and translations.

MORTON, T. G.

1877. Account of a worm (*Dracunculus* or *Filaria loa*) removed by a native woman from beneath the conjunctiva of the eyeball of a negress at Gaboon, West Africa, with a brief history of the parasite and Professor Leidy's description of the specimen. Amer. Jour. Med. Sci., (2) 74:113–16.

Specimen sent by Rev. Dr. Nassau, first brought to U. S. A., dried in transit, description scanty, clinical notes by Dr. Nassau valuable, as he had been infected personally. This and the case of an English trader also mentioned are the first records of infections among Caucasians.

NAKAIZUMI, Y.

1903. Ueber eine Filaria im Glaskörper des Menschen. Ophth. Klin., Stuttgart, 7:116–22.

Brief record of foreign body in vitreous humor which, on account of continued movement, the author regarded as a filaria. The suggestion that it was an immature *F. loa* is inadmissible; if any species, it is more probably *F. papillosa,* or *F. equina.*

NEVE, ARTHUR.

1895. *Filaria loa.* [Letter from mission hospital, Kashmir, Jan. 7, 1895.] Lancet, London, 1895, 1:446.

Reports horse with "*F. loa*" in anterior chamber of eye. Specimen lost. More probably *F. equina* common in India.

NORDMANN, ALEX. VON.

1832. Mikrographische Beiträge zur Naturgeschichte der wirbellosen Thiere. Berlin, 4°, Heft. 1, Erste Abhandl., pp., 1–54.

Gives (p. 7) the history of *Filaria oculi humani.* Small nematode in lens; not *F. loa.*

1843. Sur les helminthes dans l'oeil des animaux superieurs. (Extrait du Nordmann, 1832.) Arch. méd. comp., 1:67–113, pl.

Literal translation of Nordmann, 1832.

1843a. Ueber die Parasiten im Auge der höheren Tiere. Archiv der vergleichenden Medizin, 1:67.

Cited by Kraemer 1899. Not found; apparently an unwarranted translation of the periodical name as well as the title of Nordmann, 1843.

NORDMANN ET RAYER.

1843. Helminthes dans l'oeil de l'homme. Annales d'oculist., 9:136–77.

Reprint of so much of Nordmann (1843) and Rayer (1843) as concerns the human eye, with introduction, footnotes, and summary by the editor, Cunier.

OZZARD, A. T.

1903. *Filaria loa.* Jour. Trop. Med., 6:139. Also correction by Thompstone, *Ibid.* 6:160.

Two males and two females collected by Thompstone in Opobo, Nigeria. Description scanty; purely anatomical.

PACE, A.

1867. Sopra un nuovo nematodo. Giorn. sci. nat. ed econom., 2.

Worm taken from tumor of upper eyelid of boy; named *F. palpebralis* (nec Wilson, 1844). Not *F. loa,* perhaps *F. conjunctivae* Addario (1885, q.v.).

PENEL, R.

1904. Les filaires du sang de l'homme. CR. sect. méd. et hyg. colonial., Paris, 199–217.

The autopsy of a Congo negro in Paris showed many adult *F. loa* in the superficial connective tissue of the appendages, none elsewhere. *F. loa* appears in the eye only when young and active. It lives later elsewhere and causes transitory unexplained troubles or more often none at all.

1905. Les filaires du sang de l'homme. Arch. Parasitol., 9:187–204.

Reprint of Penel, R., 1904.

PICCIRILLI, — —.

1879. Del elmintiasi oftalmica. L'Independente, 1879:425–30.

Not seen; cited after Parona, *Elmintologia Italiana.* Small structures in anterior chamber; probably not worms.

PICK, L.

1905. [Demonstration einer durch Operation gewonnenen *Filaria loa.*] Dtsch. med. Woch., 31:1172.

Specimen taken from under conjunctiva in February, 1905. Host lived in Kamerun 1897–98, since then in Germany. No intimation of its presence until day before its removal. "The worm is an intestinal (*sic!*) parasite."

PIGAFETTA, FILIPPO.

1598. Vera descriptio regni africani, quod tam ab incolis quam Lusitanis Congus appellatur. Francoforti VV. Richter, & Th. & Io. de Bry.

Specimen sent by Rev. Dr. Nassau, first brought to U. S. A., dried in transit, description scanty, clinical notes by Dr. Nassau valuable, as he had been infected personally. This and the case of an English trader also mentioned are the first records of infections among Caucasians.

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NEVE, ARTHUR.

1895. *Filaria loa*. [Letter from mission hospital, Kashmir, Jan. 7, 1895.] Lancet, London, 1895, 1:445.

Reports horse with "*F. loa*" in anterior chamber of eye. Specimen lost. More probably *F. equina* common in India.

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NORDMANN ET RAYER.

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Specimen taken from under conjunctiva in February, 1905. Host lived in Kamerun 1897–98, since then in Germany. No intimation of its presence until day before its removal. "The worm is an intestinal (*sic!*) parasite."

PIGAFETTA, FILIPPO.

1598. Vera descriptio regni africani, quod tam ab incolis quam Lusitanis Congus appellatur. Francoforti VV. Richter, & Th. & Io. de Bry.

Falsely cited by various authors as furnishing evidence of the occurrence of *F. loa* in Africa in the sixteenth century. (Cf. Ward, 1905.)

PLEHN, FR.

1898. Die Kamerun-Küste. Studien zur Klimatologie, Physiologie und Pathologie in den Tropen. Berlin, 8°, 363 pp., 1 chart, 47 text figs.

Observed three cases in Kamerun negroes, a fourth in an English official was not seen personally. According to natives the worm occurs in the eye of goats and sheep also. Attributes to *F. loa* "probably" also certain fugitive swellings and dermal inflammations about the size of a silver dollar.

PRIMROSE, A.

1903. Filariasis in man cured by removal of the adult worms in an operation for lymph scrotum. Brit. Med. Jour., 1903, 2:1262–65.

Records two cases of *F. loa* in Canada. No examination of blood for embryos.

1905. *Idem.* Canad. Pract. & Rev., Toronto, 30:135–46.

Reprint of Primrose, 1903.

PROUT, W. T.

1902. Filariasis in Sierra Leone. British Med. Jour., 2:879–81. Rev. CB. Bakt. u. Par., 32 R:528.

One case *F. loa* in a European, two worms removed, one from eyelid, other from loose skin of penis; patient had lived in Congo, blood swarming with embryo nematodes. First case in Sierra Leone, probably introduced.

QUADRI, A.

1858. (Note dans procès-verbaux de la deuxième section, séance du 15 septembre, pp. 153–57, 3 figs.) Congrès d'Ophthal. de Bruxelles, Compte-rendus (Session de 1857). Paris.

Filaria in vitreous body determined by ophthalmoscope; pronounced by later critics nothing more than persistent hyaloid artery, although confirmed by Della Chiaje.

RAILLIET, A.

1893. Traité de zoologie médicale et agricole. 2me éd. Paris. 1re fasicule.

Brief (p. 529); no new cases or facts.

RAYER, P.

1843. Note additionelle sur les vers observés dans l'oeil ou dans l'orbite des animaux vertébrés. Archives méd. comparée, 1:113–54.

Cites thirteen cases in all, the last of which concerns a cysticercus, some others are uncertain also.

ROBERTSON, D. ARGYLL.

1894. *Filaria loa.* Medical Societies. (Ophthalmological Society. Meeting Oct. 18, 1894.) Lancet, London, 1894, 2:977–78. Also Br. Med. Jour., 2:920–21.

Woman lived eight years in Old Calabar; worm noted in both eyes, removed eight months after return; cites other cases. Discussion by Manson notes resemblance between embryos of *F. loa* and *F. diurna.*

1894a. Case of *Filaria loa* in which the Parasite was Removed from under the Conjunctiva. Ophth. Rev., 13:329–31. Rev. CB. Augenheilk., 1894:388.

Same case as 1894. Both preliminary to Robertson, 1895b.

1894b. Cas de *Filaria loa* sous-conjonctivale. Annales d'oculist., 112:336.

Literal translation of Robertson 1894a.

1895. A Case of *Filaria loa.* Ophth. Rev., London, 14:93–94.

Removal of second specimen from same patient as noted in Robertson, 1894. Preliminary to Robertson, 1895b.

1895a. [Translation of Proc. Ophth. Soc. United Kingdom, March 14, 1895.] Annales d'oculist., 113:277–78.

Translation of Robertson, 1895.

1895b. Case of *Filaria loa* in which the Parasite was Removed from under the Conjunctiva. Trans. Ophth. Soc., London, 15:137–67; 2 pl. Rev. in Arch. Ophth., N. Y., 25:421.

Records four new cases, reviews old cases, adds note on female *F. loa* from right upper eyelid of same patient and report by Manson on structure of these specimens and Logan's.

1895c. Demonstration einer *Filaria loa.* Ber. Versammel. ophth. Ges., Heidelberg, 24:238. (Pub. at Stuttgart.)

Brief description and exhibit of specimens (two females and one male) from England.

1897. *Filaria loa* [Ophthalmological Society.] Lancet, London, 1897, 1:1744.

Return of his patient to Old Calabar two years previous marked by immediate recurrence of her symptoms in aggravated form. Itching behind the eyes and swellings in the arms were most prominent and said to be almost universal in Gaboon. Return to England, but no relief. No embryos in blood, excreta, saliva, or mucus.

1897a. [Quoted on *F. loa* in London letter of July 2.] Med. Rec., N. Y., 52:104.

Brief abstract of Robertson, 1897.

1904. Letter quoted by Habershon, 1904 (q.v.).

ROTH, FELIX.

1896. *Filaria loa.* Lancet, London, 1:764. Rev. in CB. Bakt. u. Par., 19:790–91.

Native girl on Niger coast, West Africa; worm not extracted. Other cases in same village. This specimen in eyelid, wandered across to other eyelid.

ROULIN, — —.

1832. Dragonneau. Arch. gén. de méd., 30:573.

This reference is given as above by Blanchard (1899) and others. Guyon (1864) says it is wrongly attributed to Clot-Bey (q.v.) in the review where it was published. I can find no trace of a similar article by Roulin in this volume or elsewhere.

ROUX, FERNAND.

1888. Traité pratique des maladies des pays chauds. Paris, G. Steinhail, 3 vols.

Brief (3:552), no new cases, gives *F. lachrymalis* as synonym!

SAMBON, L. W.

1902. Remarks on the Individuality of *Filaria diurna.* Jour. Trop. Med., 5:381–84.

Careful critique of Annett, Dutton, and Elliott's view of the identity of *F. diurna* and *F. Bancrofti.* Some difficulties due to mixed infections, others to incomplete evidence. No other embryo in West Africa which can belong to *F. loa.* Known facts accord with probable life history as taken from other species of filaria.

1903. [Continuation of 1902.] Jour. Trop. Med., 6:26.

Annett, Dutton, and Elliott's suggestion of a diurnal mosquito as host for *F. diurna* fatal to their theory of identity. Manson's suggestion of Mangrove flies more probable; certainly to be found among Tabanidae.

SANTOS, CHRISTOVÓ JOSÉ DOS.

1833. Case recorded in Sigaud, 1844 (q.v.).

SANTOS-FERNANDEZ, D. J.

1879. Filaria en al cuerpo vitreo. Cron. méd-quir. de la Habana, 5:436–38.

Not found; cited from Surgeon General's Catalog. "Twice found nematodes in vitreous humor" (Yarr, 1899).

1882. Cron. méd.-quir. Habana, 8:116.

Cited thus by Kraemer, 1899. The page given is incorrect, and I could not find any such paper or note in volume 8.

SCHEUBE, B.

1900. Die Krankheiten der warmen Länder. Jena, G. Fischer, 2d Aufl., 661 pp., 7 pl., 5 charts, 30 text figs.

Says *F. loa* (p. 492) can be in anterior chamber, and is probable cause of Calabar swellings.

1903. The Diseases of Warm Countries. Translated from the German by Pauline Falcke. Edited by James Cantlie. London, John Bale, Sons, 2d ed., 594 pp., 7 and 12 pl., 58 text figs.

*F. loa* (p. 441); says Manson has relinquished the view that *F. diurna* is the larval form corresponding to this adult.

SCHÖLER, — —.

1875. [Demonstration.] Berlin. klin. Woch., 12:682. (13:8, discussion.)

Before Berlin Medical Society; woman with living nematode 12–15 mm. long spirally rolled and actively moving in lens. Virchow examined carefully. Interpreted by later critics as persistent hyaloid artery.

SERMON, G.,

1[illegible] Case of *Filaria oculi* occurring in practice; operation [illegible]overy. Canada Med. Rec., Montreal, 1:173.

[illegible]s a bay mare! The species certainly not *F. loa*.

SIEBOLD, C. TH. VON.

1839. Bericht über die Leistungen im Gebiet des Helminthologie während des Jahres 1838. Archiv f. Naturg., 1839, 2:152.

Brief reference to case of Guyot [Guyon?]; also to Clot. Moniez (1896) says that both names are wrong in this review.

SIGAUD, J.-F.-X.

1844. Du climat et des maladies du Brésil ou statistique médicale de cet empire. Paris, 8°.

A Filaria (p. 135) in the orbit, behind the sclerotic, in a negress of Rio Janeiro. May have been a Guinea worm, and not a *Loa*.

STELLWAG VON CARION, CARL.

1858. Die Ophthalmologie. Erlangen, 2 vols.

Quoted by Kraemer, 1889, as a case of Guinea worm in the orbit; no cases or data given, account very brief; more probably referable to *F. loa*.

STOSSICH, M.

1897. Filarie e Spiroptere. Lavoro monografico. Boll. Soc. Adriat., 18:13–162. Rev. in Zool. Centr., 5:124; Jour. Roy. Mic. Soc., 1898:63.

Brief taxonomic description (p. 21); few citations.

SUPINO, F.

1900. Sopra una Filaria dell'occhio umano. Rend. Acc. Lincei, (5) 9:85–91, 3 figs.

Not *F. loa*. Specimen from Grassi, same as Addario's (1885) *F. conjunctivae*.

TERRIN, L.

1884. Étude sur le cysticerque de l'oeil. Thèse. Fac. de méd., Montpellier, no. 78.

*F. loa* (pp. 46–48) as Obs. V., par M. Lota.

TEXIER, — —.

1903. (Cited by Penel, 1904.)

Found *F. diurna* in a subject which appeared to have been a host for *F. loa*.

THOMPSTONE, S. W.

1899. Calabar Swellings. [Letter with editorial additions.] Jour. Trop. Med., 2:89–90.

Discusses fugitive swellings at Old Calabar. Editor notes similar trouble in Robertson's patient with *F. loa,* but only "since her return home."

TRUCY, CH.

1873. Remarques sur la Filaire de Médine et en particulier sur son traitment. Thèse (Fac. de méd.) Montpellier, No. 22, 4°, 42 pp.

Regards *F. loa* as identical (p. 8) with Guinea worm and cites one case by Maurel in Gaboon who extracted worm in 1868. Complete recovery.

TURNBULL, C. S.

1878. *Filaria* in the Eye. Med. and Surg. Reporter, Phila., 39:351–55.

Only brief references to previous cases of *F. loa.* Case observed was in eye of horse.

WARD, H. B.

1902. A Record of the Occurrence of *Filaria loa,* a Human Parasite new to the United States. Science, n. s. 16:350.

Brief announcement of the specimen of Milroy and of the reading of this paper. No data given.

1903. Nematoda. Wood's Reference Handbook of Medical Sciences. Rev. Ed., 6:205–25.

Reference (p. 211) to case of Milroy and figure of posterior end of this specimen; spicules incorrectly reproduced.

1905. The Earliest Record of *Filaria loa.* Zool. Annalen, 1:376–84, 1 fig.

Shows that the illustration cited from records of early voyages as evidence of the occurrence of *F. loa* is a fancy picture and can not be interpreted in the manner suggested.

1905a. Studies on Human Parasites in North America. I. *Filaria loa.* Studies from the Zoological Laboratory N[illegible] University Studies Vol. V, p. 271.

[illegible] paper.

WILSON, F. M.

1890. Specimens of *Filaria oculi humani.* Trans. Amer. Ophthalm. Soc., Hartford, 5:727–29.

Incompletely cited by Blanchard, 1899; missionary at Benita (Gaboon) W. Africa says at intervals all natives feel worms in different parts, extract them from eye only; she had one removed at Basel (Switzerland), February, 1889, from left upper eyelid; one in Bridgeport, Conn., November, 1899, from right upper eyelid; one in Clifton Springs, N. Y., February, 1890, from beneath skin of back; and broken one July, 1890, from right upper eyelid. "So far as I have been able to obtain the evidence from the missionaries themselves, these filariae are more common in the cellular tissue than in the eyeball. From the literature we should infer the opposite."

WURTZ, R.

1904. Presentation d'une *Filaria loa.* Soc. méd. hyg. trop., séance, 20 jan.

Not seen; cited after Wurtz et Clerc, 1905.

WURTZ, R., ET CLERC, A.

1904. Éosinophilie intense provoquée par le *Filaria loa.* CR. Soc. Biol., Paris, 55:1704–5.

Young French girl in Congo with Calabar swellings and *F. loa* had no embryos in blood, but intense eosinophilia; latter known for genus *Filaria,* but not noted heretofore for *F. loa.*

1905. Nouvelle observation de *Filaria loa.* Considerations sur l'hematologie des filarioses. Arch. méd. exp., Paris, 17:260–66.

Same patient as above returned to France in June, 1903. In January, 1904, worm extracted from eye. Eosinophilia somewhat reduced, but returned later. Extreme symptoms and continuance indicate that several parasites are present. Discussion of parasite, Calabar swellings, and eosinophilia in helminthiasis.

YARR, M. T.

1899. The Filariae of the Eye. Jour. Trop. Med., 1:176–79.

Native name of *Loa* means simply "worm." Good review of previous knowledge. No new cases. Records the conjecture of Manson that the cases from the West Indies, also that of Barkan (1876) concern the adult of *F. Demarquaii,* and not *F. loa.*

ZIEMANN, HANS.

1905. Beitrag zur Filariakrankheit der Menschen und Tiere in den Tropen. Dtsch. med. Woch., 31 :420–24.

*F. loa* (p. 421) increasing in that region. Sees in *F. perstans* in blood the embryos of *F. loa* and unites *F. diurna* to *F. Bancrofti.* Not every case with *F. perstans* in blood and Calabar swellings has had *F. loa* in eye. Distribution of microfilariae in body very irregular. Data on other species, therapy, etc.

## II.—*The Newly-Discovered Shakespeare Documents*

BY CHARLES WILLIAM WALLACE

The universal interest in Shakespeare as the chief interpreter of life has carried with it energy and industry in revealing the poet as man. For a century and a half research has been eager. Malone, Knight, Collier, Dyce, Halliwell-Phillipps, Furnivall, Lee, and the army inspired by their banners have, one would suppose, left no ancient tome or record unexplored for even the slightest evidence touching the poet's life and career. The results have been gratifying beyond expectation. Modern scholarship, particularly the judicial work of Mr. Sidney Lee, has brought the materials into proper perspective and enlightened them. But for a full generation no record or document bearing the poet's name or directly touching his life has been revealed, and scholars have long felt that no more were to be found. Consequently when the writer of this article announced to distinguished Shakespeare scholars and friends in England, America, and Germany, during the autumn of the present year, and later published in London the discovery of three ancient documents touching the last year of the poet's life, considerable interest was aroused.

As previously announced, these documents were discovered in the Public Record Office at London while the writer was making a systematic research concerning the children companies at Blackfriars and Whitefriars theaters from 1597 to the middle of the reign of James I. His researches in this field in various libraries and public archives during his absence from the University of Nebraska the past year have brought together documents and other evidences hitherto undiscovered or unused or unrelated in stage and dramatic history, concerning which, it is hoped, further information can be furnished in some future number of the *Studies*.

UNIVERSITY STUDIES, Vol. V, No 4, October, 1905.

Certain *Hamlet* problems are also involved as an essential part of the investigation into the history of the children companies.

In carrying out his investigations in the Public Record Office concerning "Blackfriars" and "Whitefriars," taking into account all the index subheads,—not only "theater" and "playhouse," but also "lands," "messuages," "rooms," etc.,—the writer came in natural course upon the following documents. Aside from being classified they had apparently not seen the light for nearly three hundred years until they came into the present hands.

These records are the result of a suit in the Court of Chancery in which William Shakespeare was one of the plaintiffs and Mathew Bacon defendant. The suit relates to the titles of certain "dwelling houses or messuages" owned by Shakespeare and fellow plaintiffs a little east of the famous old Blackfriars theater.

The three documents, Bill, Answer, and Decree, date respectively April 26, May 5, and May 22, 1615,—the closing year of the poet's life. The property in question was formerly owned by the Blackwells and Ann Bacon, widow. According to the custom of placing records of property in private hands for safe keeping in "box, bag, or chist" in lieu of a public repository for such things, certain "deeds, charters, letters patent," etc., essential to the titles of property possessed by Shakespeare and neighboring owners had been "left in trust with Ann Bacon," rightly say the plaintiffs, for their "use and behoof." But "Ann Bacon being lately dead," these papers came into the hands of her son and sole executor, Mathew Bacon, who as defendant denies knowledge of any trustship by either his mother or himself. He admits possession of the papers simply as executor and holds he can not make legal delivery until discharged by the court, even though willing. He feels, therefore, the suit is unjust.

The Lord Chancellor's decision establishes the justice of the cause by granting to Shakespeare and associates the full request made in their Bill. Moreover, he gratuitously suggests that they may take further action to secure themselves if they will. As the decision was of such favorable nature, the plaintiffs had no reason to doubt the Court's just disposition of the papers, and did not avail themselves of the suggested privilege. I find no record of farther suit.

This is the first important addition to the list of documents touching the life of Shakespeare since the discoveries by J. O. Halliwell in 1870.[1] Of approximately one hundred seventy-five evidences[2] upon which rests the history of the poet's family, life, and works, these take their place among that limited class of legal and other official records made between his birth and death, and containing the name of William Shakespeare. This list has hitherto numbered twenty. Six entries relating to births, marriage, and deaths; the privy seal and patent to the King's company of players; a record of assessment in Bishopsgate; five evidences of property ownership in Stratford and county Warwick; two documents in a suit and one in an agreement over the Stratford tithes; the poet's will; the deed and mortgage concerning Blackfriars property. Most of these have been known for more than one hundred twenty-five years.

The only signatures of the poet are in this small list,—three times in the will, once in the deed, and once in the mortgage of Blackfriars property of present concern. These latter three documents, because of the signatures and the information furnished, are the most valuable of all.

The newly discovered records are of less worth than the three signed documents, but in comparison with the other seventeen they furnish their fair quota of information. Of course a final statement can not yet be judicially made because all clues have not been followed out. Every new name and new fact suggests lines of further research. These may serve to trace ancient

[1] See Halliwell's announcement in *The Athenaeum*, August 13, 1870, concerning the Blackfriars Share-papers of 1635, etc. These and other discoveries were first published in his *Illustrations of the Life of Shakespeare.* Lond. 1874. Minor records, mainly from Stratford, were published by him from time to time until 1884, all of which are now collected in his *Outlines* (*ut infra*).

[2] For all known evidences see the following:

J. O. Halliwell-Phillipps: *Outlines of the Life of Shakespeare.* Eighth Edition. Lond. 1889. [Contains all records then known, but not chronologically arranged.]

D. H. Lambert: *Shakespeare Documents; A Chronological Catalogue of Extant Evidence*, etc. Lond. 1904. [Indispensable and convenient, but not complete.]

Sidney Lee: *A Life of William Shakespeare.* Fifth edition (Revised). Lond. 1905. [The last judicial weighing of evidences.]

deeds and wills. The hope, however, of reaching the "deeds, charters, letters patent," etc., that occasioned this suit seems not alluring. My later investigations in the Guildhall and elsewhere, satisfy me that if they are ever found, it will be only by accident rather than by systematic research. After the Lord Chancellor called these papers into court and disposed of them as seemed meet, they were again doubtless placed in private hands in trust. No one can say where to look for them. They may have gone long ago to the toy drum-head, the glue-pot, the bonfire, or the cook's kindling-box. Or they may yet lie stored in some lawyer's vault, or be hidden in "box, bag, or chist" of some private family.

Two months ago a friend of the writer rescued, in one of the inns of court, an armful of old parchments which the janitor was carrying out to be burned. They proved to be valuable court records of Henry VIII. Recently while visiting at an ancient mansion near London the writer saw a manuscript book of cookery and general recipes dating from Elizabeth and James I.,—the only ancestral MS. relic the present owner rescued from a box in a garret from which the maid had for some time drawn a supply of kindling. Not long ago an official suggested to me the propriety of printing the Privy Council Registers in thin volumes, with small type, and burning the originals because they took up so much room. The Library Committee of the Guildhall some years ago recommended in their published report that a lot of "unimportant" records lying loose on the floor of one room of the city archives should be burned to make room for more valuable material.

The above are instances which every searcher for original records can duplicate and sometimes centriplicate. They show the improbability of reaching the privately kept records once held by Ann Bacon. Of course it is clear that these did not include Shakespeare's deed or mortgage, which were taken in charge by their respective owners, but did include all earlier records and transfers pertaining not only to his property but to that of the others both before and after the original tract was split up and sold in parcels. Such documents were essential evidences in maintaining or transferring title, and served as orig-

inal records and abstract in one. Of course when an original tract was split up into perhaps a dozen parcels, it was not possible to split the original documents also, nor divide them out to individual owners. Hence the custom, exhibited in the present documents, of several owners entrusting the original "letters patent, charters," etc., to one and the same person,—probably the largest owner. And hence also such a community suit as the present one. It is likewise clear, therefore, that even if all these records could be found, they would yield no evidence pertaining to Shakespeare personally, and certainly no signature of his. They should simply give definite and final locations.

Ancient wills seem to offer the only definite starting point. If found, they should enable us to get at the history of the persons involved in the suit and possibly thus determine what, if any, further relations existed between Shakespeare and the rest. They might also help locate the properties,—a goal hardly alluring enough in itself for long search. The identity of Sir Thomas Bendish is already fixed by his title of "Baronet." He was an Essex man of wealth and influence, and was the twenty-second person raised by James I. to a baronetcy soon after the establishment of that order in 1611. His son, also a Sir Thomas, was one of the chief partisans of Charles I. The other names—particularly Robert Dormer, the Bacons, and the Blackwells—are met with often in other documents, but without identifying or other helpful evidence. The titles "Esq." and "gent" are too general to be of aid.

Since the announcement and publication of the documents in *The Standard,* numerous reviewers in their enthusiasm have been over-generous in their hopes and expectations of unexplored Shakespeare mines in the Public Record Office and elsewhere, with a possible complete diary by Ben Jonson or other intimate friend. It seems also quite generally believed that we know very little about Shakespeare. The truth is, the hundred seventy-five or more evidences on which his biography rests give us more information than we possess concerning most of his contemporary dramatists. Also even the information in the present discovery, meager as it is, exceeds the total sum of knowledge concerning certain of his minor fellow writers and players.

The documents as reprinted below,[1] with some unimportant typographical corrections, are believed to be accurate. The present writer is personally responsible for the transcripts. There is no spacing, in the documents, under the marks of abbreviation (ˆ, ˜) used. It is not always certain whether the writer of the Bill means an initial for capital or small letter. Often the difference seems a matter of mere gradation. In many cases, and particularly with reference to the interlineations, the officials in charge of the Legal Room rendered expert assistance. No significance, of course, attaches to the interlineations. They are such as are found in almost every legal document of any length. The original of Shakespeare's will, for example, at Somerset House, shows fourteen. It suffices in the present case that the interlineations were made by the original hand and were there when the Bill was filed in court, April 26, 1615. This is sufficiently shown by the fact that the defendant's answer thereto contains the names in the same order but with no interlineations.

The documents are the property of the English government, and are preserved at the Public Record Office. The Bill and Answer, like all such records, are on parchment and are fastened together at one corner. The decree is in a ponderous volume about fifteen inches thick. At the head of their respective texts are given the index of suit and decree, by which the originals can at any time be looked up and examined.

Chancery Proceedings, Bills and Answers, James I., Bundle B 11, No 9.

I. Bill of Complaint

xxvj^to^ die Aprilis 1615

Saunders

To the Right Honorable S^r^ Thom^s^ Egerton knight Lord Ellesmere and Lord Chancello^r^ of England

Humblie Complayninge sheweth Vnto yo^r^ Honorable Lo^p^ yo^r^ Daylie Orato^res^ S^r^ Thom^s^ Bendish Baronet Edward Newport and Willyam Thoresbie Esq^r^ Rob^t^ Dormer Esquio^r^ and Marie his wife Willyam Shakespere gent[2] and Richard Bacon Citezen of London

[1] First published with a column introduction in *The Standard*, London, October 18, 1905, p. 5.

[2] The words "and Marie his wife Willyam Shakespere gent" are interlined.

That Whearas Yo^r^ Orato^rs^ be and are seu^r^allye Lawfullie Seised in there Demesne as of ffee of and in One Capitall Messuage or Dwellinge howse w^th^ there app^r^ten^a^nces w^th^ two Court Yardes and one void plot of grownd sometymes vsed for a garden on the East p^te^ of the said Dwellinge howse and so Much of one Edifice as now or sometymes served for two Stables and two haye Loftes over the said Stables and one litle Colehowse adioyninge to the said Stables Lyinge on the South side of the said Dwellinge howse And of another Messuage or Tenem^te^ w^th^ thapp^r^ten^a^nces now in the occupacõn of Anthony Thompson and Thoms Perckes and of there Assignes & of a void peece of grownd whervppon a Stable is builded to the said meassuage belonginge[1] and of seu^r^all othere howses Devided into seu^r^all Lodginges or Dwellinge howses Toginther w^th^ all and singuler Sello^rs^ Sollers Chambers Halls plo^rs^ Yardes Backsides Easem^tes^ pfites and Comodityes Hervnto seu^r^allie belonginge And of Certaine Void plots of grownd adioyninge to the said Messuages and p^r^misses aforesaid or vnto some of them And of a Well howse All w^ch^ messuages Tenement^s^ and p^r^misses aforesaid be Lyinge w^th^in the p^r^cinct of Black ffriers in the Cittye of London or Countye of Midd late the Messuages Tenem^tes^ and enheritances of Willyam Blackwell thelder Henrie Blackwell and Willyam Blackwell the Younger and of Ann Bacon or of some of them Vnto w^ch^ foresaid Capitall Messuages Tenem^tes^ and p^r^misses aforesaid seu^r^all Deedes Ch^r^es Letters patentes Evidences Munim^tes^ and Wrightinges be and are belonginge and appteyninge and do belonge vnto Yo^r^ Orato^rs^ and Doe serve for the pvinge of Yo^r^ Orato^rs^ Lawfull right title int^r^est and estate in to and vnto the foresaid Messuages and p^r^misses All w^ch^ foresaid Letters patentes Deedes Evidences Ch^r^es munim^tes^ and Wrightinges aforesaid were left in trust w^th^ Ann Bacon deceassed for and vnto the vse and behoofe of Yo^r^ Orators Now so Yt is May Yt please Yo^r^ Honorable Lo^p^ that the said Ann Bacon beinge latelie Dead and Mathy Bacon beinge her sole execuro^r^ the foresaid Letters patentes Deedes Ch^r^es and Evidences Munim^ts^ and Wrightinges aforesaid be since her Death come vnto and now be in the handes and posson of the foresaid Mathy Bacon who doth not Clayme any right estate or int^r^est at all in or vnto the foresaid Messuages or Tenem^tes^ Yet neu^r^theles the said Mathy Bacon Knowinge the Messuages Tenem^tes^ Letters patentes Deedes Evidences Ch^r^es Munim^tes^ and Wrightinges aforesaid to be belonging and onelie to belonge to Yo^r^ Orato^rs^ Doth neu^r^theles W^th^hould keepe and Deteyne awaye from yo^r^ Orato^rs^ the foresaid Letters patentes and other Deedes Evidences Ch^r^es Munim^tes^ and Wright-

[1] The words "and of there Assignes & of a void peece of grownd whervppon a Stable is builded to the said meassuage belonginge" are interlined.

inges aforesaid and will not deliu$^{r}$ the same vnto Yo$^{r}$ Orato$^{rs}$ Wherby Yo$^{r}$ Orato$^{rs}$ be in great Danger for to Loose and be Disinherited of the messuages Tenem$^{tes}$ and p$^{r}$misses aforesaid In tender Consideracon Wherof and forasmuch as Yo$^{r}$ Orato$^{rs}$ have no remoudye at and by the Course of the Comon Lawes of this Realme for to have the said Letters patentes Deedes Chr̃es Munim$^{tes}$ Evidences and Wrightinges Deliu$^{r}$ed vnto Yo$^{r}$ Orato$^{rs}$ for that yo$^{r}$ Orato$^{rs}$ Doo not knowe the Certaine Dates nor pticuler Contentes of them nor Whither they be in Box Bag or Chist sealed or Locked Therfore that the said Mathy Bacon maye make Direct Answere vnto the p$^{r}$misses and maye set Downe expresslie what Lett$^{rs}$ patentes Deedes Evidences Chr̃es munim$^{tes}$ or Wrightinges he hath in his handes or knoweth where they be w$^{ch}$ Conc$^{r}$ne Yo$^{r}$ Orato$^{rs}$ or the Messuages and p$^{r}$misses aforesaid or any of them and the same maye bringe into this Honorable Court to be deliu$^{r}$ed vnto Yo$^{r}$ Orato$^{rs}$ Maye Yt please yo$^{r}$ Lo:$^{p}$ to grant to Yo$^{r}$ Orato$^{rs}$ his Ma$^{tes}$ most gracious writt of Subpena and also of Ducens tecū vnto him the said Mathew Bacon to be Directed Comandinge him therby at a Certaine Daye and vnder a Certaine payne therin to be Lymited psonallie to be and appeare before Yo$^{r}$ Lo:$^{p}$ in his Ma$^{tes}$ high Court of Chancerie then and there for to make Answere vnto the p$^{r}$misses and also to bring w$^{th}$ him the said Letters patentes Deedes Evidences Chr̃es and Wrightinges into this Honorable Court and to stand to and abide such further Order therin as to yo$^{r}$ Honorable Lo:$^{p}$ shalbe thought fitt And yo$^{r}$ Lo$^{ps}$ Daylie Orato$^{rs}$ shalbe in all Dewtye Bownd to pray for yo$^{r}$ good Lo:$^{p}$ in all health and happines long to Contynue.

LOCK

II. Answer of Defendant.

Jur 5 Maij 1615 Mat:Carew
Pennyman

The answeare of Mathye Bacon gent Defend$^{t}$ to the bill of complaynte of S$^{r}$ Thomas Bendish Baronett Edward Newport esqr william Thoresbye esquier Robert Dormer esquier and Mary his wife william Shakespeare gent and Richard Bacon Citizen of London Compltes.

The said Defend$^{t}$ savinge to himselfe nowe and all tymes hereafter all advantage and benefitt of excepcōn to all and every the incertenties & insufficiencies of the said bill of complaynte saieth

that hee thinketh it to be true that the said Compltes are lawfullye severally seised in theire Demesne as of fee of and in one capitall messuage or dwellinge house w$^{th}$ thappurtenances and other the tenementes Stables edefices and voide groundes mencōned in the said bill of complaynte and likewise thinketh it to be true that the same were late the messuages tenementes and inheritances of William Blackwell the elder deceased Henry Blakwell and william Blakwell the yonger and of Anne Bacon deceased mother of the said Defend$^{t}$ or of some of them And this Defendant further saieth that hee doth not nowe clayme to haue any estate right title or interest of in or to the said p$^{r}$misses or any parte or parcell thereof And hee also saieth that one ẗres patentes and certeyne deedes evidences writinges and mynumentes concernynge the said messuages tenementes and other the p$^{r}$misses mencōned in the said bill of complaynte or some of them are come to the custodie & possession of this Defend$^{t}$ as executor vnto the said Anne Bacon his mother But this Defend$^{t}$ denieth that the said ẗres patentes evidences writinges and mynumentes or any of them were left in trust with the said Anne Bacon for and to the vse and behoofe of the said Complayn$^{tes}$, or any of them to the knowledge of this Defend$^{t}$ in any such manner as in the said Compltes bill is sett forth and alledged And this Defend$^{t}$ further saieth that hee doth not certeynelie knowe whether the said ẗres Patentes evidences writinges and mynumentes doe onlie belonge vnto the said Complaynantes or any of them or to any other p̄son or p̄sons aswell as to the said Compl$^{tes}$. And therefore hee this Defend$^{t}$ hath deteyned the same vntill such tyme as hee may be lawfully and orderlie discharged thereof vpon his deliu$^{r}$ie of the same And soe as hee may be discharged and saved harmles from all further trouble charge and damage w$^{ch}$ maie hereafter happen vnto him for or concernynge his possession of the said ẗres patentes deedes evidences writinges and mynumentes hee this Defend$^{t}$ is and wilbe readie to deliver all such ẗres patentes evidences writinges and mynum$^{tes}$ concernynge the p$^{r}$misses as came to the custodie and possession of this Defend$^{t}$ to his knowledge and doe of right belonge vnto the said Complaynantes or any of them, vnto such p̄son or p̄sons and in such sorte as this Honorable Co$^{rt}$ shall order and thinke meete without that that anie other matter or thinge in the said bill of complaynte mencōned materiall or effectuall in lawe to be answeared vnto And herein before not sufficiently answeared vnto confessed and avoyded traversed or denied is true All w$^{ch}$ this Defendante is and wilbe readie to averre maynteyne and prooue as this most honorable Court shall awarde And Humblie prayeth to be dismissed forth of the same with his reasonable costes and charges in this behalfe most wrongfully susteyned.

BLAKWELL

III. Decree of the Court

Court of Chancery, Decrees and Orders, Vol. 1614 "A," p. 1074.

xxij Die Maij

Thomas Bendishe Kt & Baronet
Edward Newporte et al p^les
Mathias Bacon gent Def^t

Whereas this Corte was this p^nte Daie informed by mr Rchard Moore beinge of the p^les Counsell that the said p^les beinge seised in ffee of one Cappitall messuage wth the appurtennces scituate in Black fryers and that Divers the letters Patentes Deedes evidences Chr^es mynum^tes and writinges concerninge the same Did heretofore come vnto the custodye of Anne Bacon, the Def^ts mother as executrix to her mother whoe latlie Dyed and made the Def^t her executor and that by meanes hereof the said letters Patentes Deedes evidences and Che^rs mynum^tes & writinges are nowe Come vnto his handes for obteyninge whereof the said p^les have exhted there bill into this Corte wherevnto the Def^t have^ng Aunswered doth by his said Aunswere Confesse that one letters Patentes and certeyne Deedes evidences & writinges & mynum^tes concernenge the said messuages and p^misses in the bill menconed are come into his handes and possession the said def^t not makeinge any Title therevnto but desiringe that he maye be orderlie dischardged thereof vpon delivery of the same as this Corte should thincke fitt, and therefore It was desired that the said letters Pattentes and other the deedes evidences and writinges soe Confessed might be brought into this Corte vppon the defts oath It is threvppon ordered that the said def^t shall bringe into this Corte all the said letters Patentes deedes evidences writinges & mynum^tes soe by him Confessed to be in his custodye or possion vpon his oath here to remayne to be disposed of as shalbe meate and for that purpose the p^ltes maye take proces against the def^t if they will.

## III.—*State Control and Supervision of Charities and Corrections*

BY ANDERSON WILLIAM CLARK

### PREFACE

The problems of charity and correction are many and complex. In the midst of our social development these problems have greatly increased in number and in importance within the last few years. Differentiation, which has been rapid in the past, will be accelerated in the future. Classification has gone forward until we have separate institutions for the insane, feeble-minded, epileptics, orphan and crippled children, blind, deaf-mutes, the aged poor; also hospitals for the treatment of particular forms of sickness, including contagious and other diseases. Some of these institutions are managed by the state, some by the county, some by the city, and others by private societies. We have organized forms of relief such as associated charities, day nurseries, diet kitchens, employment bureaus, medical dispensaries, visiting nurses' associations and societies to relieve distress in the home. For dealing with offenders we have national prisons, state prisons, county jails, city jails, bridewells, lockups, state reformatories for men and women, state reformatories for boys and girls, juvenile courts, and prisoners' aid associations. These organizations in charity and penal work are very numerous. In New York City alone, as appears from the New York Charities Directory in 1904, there are 3,086 institutions and societies engaged in charity work. This great number in a single city gives us an idea of the complexity of the problems and of the extreme differentiation in methods of handling them. New methods are constantly devised for the treatment of pauperism, for the prevention of crime, for the reformation of the criminal, and for correcting dangerous criminal tendencies. Dangers from environment in childhood and signs

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of criminal tendencies will be carefully studied and preventive plans adopted which no one to-day can foresee.

In order to learn these complex problems at first hand the writer visited Massachusetts, New York, Ohio, Michigan, Illinois, Iowa, Minnesota, and other leading states. He examined records and made diligent inquiries of public officials and of the officers of private societies. Both public and private institutions were inspected, their present conditions studied, and their past methods investigated.

## INTRODUCTION

What should be the position of the state with reference to the many and complex problems of charity and correction? Where is the limit to state authority and the limit to state control and supervision? Where is the dividing line between public and private charities? These and similar questions have had the earnest attention of students of society and of social workers, and are pressing upon us as never before. Their solution must be found in part at least in the light of experience. What have the various states been doing with these problems? What experiments have been tried and what do their results teach?

The early period in the settlement of this country was a period of decentralization. New towns and new communities were rapidly formed. As this process went forward it became more and more difficult to administer the functions of government from one center. Distances from the center became so great and travel was so slow that local administration was more efficient than central administration, and in many cases a necessity. Thus the process of decentralization went on until, in the nineteenth century, new forces came into operation which, by changing conditions, changed the current of development.

The railroads, the telegraph, cheap postage, and other improved means of travel and of communication produced marvelous results. They led to the rapid growth of cities and to the centralization of capital in large industries.

The tide was then changed in regard to public administration, and centralization began. The movement in that direction has

gone steadily forward in all departments. In the matter of public education in nearly all the states there is recognition of state control and supervision in reference to levying of taxes, erection and repairs of school buildings, fixing salaries, terms of school, courses of study, and qualifications of teachers. The "district system" and the prejudices of the people in favor of local self-government have greatly hindered progress in centralization in some states. Especially has this been true in Ohio. Less progress seems to have been made in that state towards centralization of the public school system than elsewhere. On the other hand, in Massachusetts and New York strong forces have been active for half a century tending toward centralization and state control. The same centralizing tendencies seen in the public school system have been manifested in reference to public highways and in sanitation.

In the field of charities and corrections the tendencies toward centralization have been very marked. The movement towards state control has gone steadily forward in Massachusetts and in New York until in both states there have been established lunacy commissions and prison commissions, which are boards of control. In New York the finances of all charitable and penal institutions have been completely centralized. Other departments of charity and correction have come so completely under state control that it may be said that these states have realized what is meant by a state board of control and at the same time have retained the advantages of the advisory state board of charities.

Similar results have been reached in Wisconsin where an advisory board of state charities performed faithful labors for ten years, from 1871 to 1881, when a state board of supervisors was created. These two boards continued in operation until the year 1891, when centralizing tendencies in that state became so strong that the legislature abolished both boards and established the state board of control, which has been in effective operation ever since.

Minnesota tried an advisory state board of charities under the most favorable circumstances for nineteen years, when the centralizing forces in that state led the legislature to abolish it in 1902 and to establish a state board of control.

Similar tendencies toward state control have been observed in other states in matters of charity and correction as well as in other branches of administration. This subject, therefore, is one of special interest and importance to the students of political science as well as to the practical workers who are dealing with the problems of charity and correction.

## I

### STATE BOARD OF CHARITY OF MASSACHUSETTS

It is of peculiar interest to study the history of this state board of charities, first, because it was the first board of the kind organized in this country, and, secondly, because the work of the board and, in fact, all the charities of Massachusetts are believed to be more completely organized than in any other state of the Union.

The beginnings of this board date back to 1856, when the legislature created a Board of Commissioners on Charities.

The supervisory authority of this board was limited to state almshouse visitations, but its administrative powers extended to the execution of all the laws relating to alien immigrants; the prescription of forms for statistical returns from the state almshouses at Tewksbury, Bridgewater, and Monson, and the form of certificate permitting the introduction of inmates thereto; the binding out of apprentices from the State Hospital at Rainsford Island; the control of state pauper inmates of the state lunatic hospitals and their property; and the transfer of pauper inmates from one state charitable institution or lunatic hospital to another, and their transportation to their homes in other states and other countries, the last-named duty involving a rigid inspection of all passengers arriving from foreign ports, and the exclusion of those liable to become public charges.

The legislature of 1863 abolished the Board of Alien Commissioners and established the Board of State Charities. To this board was entrusted all the administrative authority conferred upon the Board of Alien Commissioners, and it was also made its duty to "investigate and supervise the whole system of the

public charitable and correctional institutions of the commonwealth"; but its supervisory power was subsequently limited by the transfer, in 1875, of the oversight of the institutions for the instruction of the deaf, dumb, and blind to the Board of Education, and by the further transfer, in 1879, of the oversight of the correctional institutions of the state to the Board of Commissioners of Prisons. On the other hand, the executive authority of the new board was considerably increased by the acts of 1865, 1866, 1869, 1870, and 1877, charging the board with the execution of the laws relating to the unsettled poor in the several cities and towns of the commonwealth and to the children of the state.

The authority conferred upon the Board of State Charities by the legislation of 1869 and 1870 with reference to the minor wards of the state was substantially as follows:

Whenever a complaint was made against a boy or girl under the age of seventeen years, the court or magistrate in the case was required to notify the board in writing, so that one of its agents might have opportunity to investigate the case, attend the trial, and protect the interest of, or otherwise provide for the child. On the agent's request, the court or magistrate might authorize the board to take and indenture or place in charge of any person, or in the State Primary School, such child, till he or she attained the age of twenty-one years, or for any less time. No child could be indentured, adopted, or taken in charge of any person from a state institution until notice thereof had been given the board, and its report in writing, made after investigation into the propriety thereof, had been filed with such institution; and all the applications for the release or discharge of any children so indentured or placed in charge of persons were to be given to the board for its report in like manner. As often as once a year all children so maintained, indentured, or placed were to be visited, and such other investigation made in regard to them as the board might prescribe.

The legislature of 1879 abolished the Board of State Charities, and established the State Board of Health, Lunacy, and Charity, thus conferring upon the new board, in addition to the powers of its predecessor, all the power and authority previously pos-

sessed by the Board of Health and Vital Statistics, which was organized in 1869. In 1896, however, the State Board of Health was reestablished, and it was provided that "the board heretofore known as the State Board of Health, Lunacy, and Charity, shall be hereafter called the State Board of Lunacy and Charity."

The legislature of 1898 passed an act (chapter 433, acts of 1898), establishing a State Board of Insanity, and providing that "all the powers possessed by and all the duties incumbent upon the State Board of Lunacy and Charity relative to the state hospitals and asylums for the insane and to other institutions, asylums, and receptacles for the insane or feeble-minded, public or private, relative to insane persons generally, and as commissioners in lunacy, relative to the Massachusetts Hospital for Epileptics, the Massachusetts Hospital for Dipsomaniacs and Inebriates, the Massachusetts School for the Feeble-minded, and the hospital cottages for children, are hereby taken from the said State Board of Lunacy and Charity and vested in the State Board of Insanity, and said State Board of Insanity is hereby authorized and empowered to assume and exercise the same. The said State Board of Insanity shall also succeed to all the rights, powers, and duties of the said State Board of Lunacy and Charity in respect to all the insane poor placed in families by the latter board, and said insane poor so boarded out are hereby transferred to the care, custody, and control of the said Board of Insanity without further process of law. The State Board of Lunacy and Charity shall hereafter be called the State Board of Charity, and shall have and exercise all the powers now possessed by it, and all the duties now incumbent upon it, except when otherwise by law provided, including all questions relating to the settlement or non-settlement of the state poor coming under the control of the state institutions under its supervision, and under the supervision of the State Board of Insanity, and shall administer the laws of settlement relating to the support of the state's sane poor by cities and towns, and shall prosecute all cases of bastardy of non-settled persons."

The institutions under the supervision of the State Board of Charity are the Lyman School for Boys and the State Industrial

School for Girls, the State Sanatorium for Consumptives, and also the State Hospital at Tewksbury and the State Farm at Bridgewater, so far as their sane inmates are concerned. The immediate management of the Lyman and Industrial schools is in the hands of a separate board of trustees, and the State Hospital and State Farm are also under a single board of trustees. The State Sanatorium also has its own board of trustees. The state board is required to visit the several truant schools of the state, and make report on their condition. It is charged with the care and maintenance of indigent and neglected children coming into its custody through commitment by the courts or otherwise; and it administers the laws regarding abandoned infants and infant boarding-houses. It is required to visit, not only the children in its immediate care and custody, but also "all minor children supported at the expense of any city or town,"[1] and a recent law authorizes it to visit and inspect all places where town paupers, whether children or adults, are supported in families. It prescribes the form of certificates required of local overseers of the poor in sending paupers to the State Hospital. It may transfer sane pauper inmates from one state charitable institution to another, or send them to any state or place where they belong. When local overseers of the poor fail to comply with the law forbidding the retention in almshouses of pauper children over a certain age, the authority vested in said overseers may be exercised by the state board to the exclusion of the overseers. In cases of sick state poor supported by cities and towns, and state poor temporarily relieved, as well as in cases of burial, the state board has large administrative authority, including the visitation of the several cities and towns of the commonwealth by its agents, the investigation and decision of settlements of both sane and insane persons, and the auditing of bills of local authorities against the commonwealth. The board is required to prepare, from the returns made by overseers of the poor, tables of paupers supported by towns, and to "print in its annual report the most important information thus obtained." An act of 1899 requires

[1] Public Statutes, chap. 89, sec. 53.

annual returns to be made to the board by certain untaxed charitable corporations.

The board receives from the legislature, $300,000 to $400,000 annually, to expend in direct relief work for the adult poor of the state, for dependent children, and to cover expenses of the board.

The legislature of 1903 added to the administrative powers of the State Board of Charities. Relative to the removal of state paupers, the language used in chapter 355 of the acts of 1903 is as follows:

"If any such person refuses to submit to removal, the State Board of Charity, or any of its officers or agents may apply to the district, municipal, or police court of the district where such person resides, or to any trial justice, for an order directing that such removal be made. Upon such application the court or magistrate shall forthwith cause a summons to be served upon the person so refusing, and, if he be a minor, upon his parent or guardian, requiring the attendance of the person so summoned at a time and place appointed therein for hearing; and at such time and place shall hear and examine upon oath such person or persons, and shall hear such other evidence as may be material. If upon hearing it appears that the person sought to be removed is without a legal settlement in this commonwealth and is unable to support himself, and that his necessities or the public interests require his removal, the court or magistrate shall issue an order in writing, directed to a duly constituted officer or agent of the State Board of Charity, reciting that such person appears to be a state pauper, and that his necessities or the public interests require his removal, and commanding such officer or agent to remove him to the State Hospital or to any other state institution designated by the State Board of Charity, and such officer or agent shall thereupon make the removal as ordered."

In chapter 330 of the acts of 1903, additional powers of control and supervision relative to truant children are given to the State Board of Charity. It is specified that "If the girl be under twelve years of age, she shall be committed to the custody of the State Board of Charity," and further, "If a girl, who is com-

mitted to the custody of the State Board of Charity, proves unmanageable in a private family, she may be committed by the State Board of Charity to the State Industrial School for girls."

The same is true concerning dependent children. The powers and responsibilities of the board were increased by the legislature of 1903. Relative to crippled and deformed persons, it was resolved in chapter 96, "That the State Board of Charity is hereby authorized and directed to make as practical investigation as possible, as to the number of crippled and deformed persons in the commonwealth, under twenty-one years of age, who are not able to attend the public schools by reason of their physical deformity, and shall report to the next general court."

Many years ago the people of Massachusetts were led to the belief that the state should relieve distress wherever found in the commonwealth, upon the same moral grounds that individuals assist their fellows in times of destitution, distress, and necessity. Growing out of this judgment fifty years ago the State Almshouse was established, now known as the State Hospital, located on a large farm called the State Farm. The people believe in this principle to-day more strongly than in former years. At the time of a recent visit to the State Farm 1,300 of the poor of that commonwealth were found receiving state care, and it was learned that at times the number reached 1,600. It is mostly a moving population, many of the inmates remaining but a few days. The daily admissions average twenty-five to thirty. An important feature of the work is the splendid care given to dependent old people who are given comforts and homelike surroundings, many of them having come here to spend the remainder of their lives.

The entire history of the State Board of Charities from 1856 to the present time shows a constant tendency towards centralization and state control of all charities.

### STATE BOARD OF INSANITY OF MASSACHUSETTS

Centralization is also seen in the history of the lunacy commission. The Commissioners of Lunacy of Massachusetts occupy a unique position, in that this commission constitutes a board

of control between the local boards of trustees and the governor. The hospitals for the insane of the state contain, on the average, 9,500 patients. This large population made it necessary to separate this work from the State Board of Charities, and to create a special board of control, which was done in 1898. The chairman of the commission, on salary, devotes his entire time to visiting, inspecting, and managing affairs relative to the insane of the state. All vouchers, after being endorsed by the trustees, must be sent to the commissioner, who forwards the same to the auditor.

STATE BOARD OF PRISON COMMISSIONERS OF MASSACHUSETTS

Massachusetts, with a population of 3,000,000, has a large foreign population, and statistics show that 60 per cent of all crimes in that state have been committed by foreigners. The conditions have been such that great difficulties in prison administration presented themselves, which led the state to create a special Prison Commission in 1876. These commissioners were given important powers to control and supervise the State Prison and the State Reformatory. They soon found that the contract system of prison labor was unsatisfactory, and by act of the legislature it was wholly abolished. In their opinion it will never be brought up again for consideration or debate. The "piece price" system was also abolished, and the state has absolute ownership and control of all industries connected with prisons. One section of the law provided that the prison commissioners shall, as far as possible, cause such articles and materials as are used in the public institutions of the commonwealth and of the several counties which are established to be produced by the labor of prisoners. Another section of the law provides that all state institutions shall communicate with the Prison Commissioner and shall purchase through him such articles as may be needed in these various institutions as far as they can be supplied by prison labor. Machinery is used in both the State Reformatory and the State Prison. The results are very satisfactory, especially in the manufacture of blankets, boots, shoes, slippers, brooms, brushes, cloth, clothing, furniture, harness, mats, rugs, hosiery,

and yarns. The commissioners have made a careful study of the type of education and the system of physical training and discipline best adapted to prisoners, and have power to enforce recommendations. This commission is, in reality, a state board of control in all matters relating to prison administration.

## II

### STATE BOARD OF CHARITIES OF NEW YORK

The history of charities and correction in New York presents many stages of centralization in control and management. During the colonial period, beginning with the laws passed by the Assembly in 1691, the entire problem of poor relief and care of the insane was left to the towns. For more than one hundred years this form of administration continued. It was not until 1809 that county poor relief was recognized by statute. In 1820 Rensselaer county erected a House of Industry, which was the first poorhouse constructed on the American continent. This new system rapidly commended itself, so that in 1824 poorhouses were erected in eighteen other counties.

Provision was made by the state in 1819[1] for care and education of the deaf and dumb, which was the first relief work of any importance undertaken by the state. It was not long after this until additional work was undertaken by the state, and in 1843[2] the first state lunatic asylum was opened at Utica.

The third important step by the state was in 1846[3] when the State Industrial School or House of Refuge for Juvenile Delinquents was established at Rochester.

Soon after this other state institutions were founded for idiots, for blind, etc.

The decade from 1860 to 1870 marks a new period in the movement toward centralization of control in charity administration. In 1867 the New York State Board of Charities was

[1] Laws of 1821, chap. 250; 1822, chap. 324; 1823, chap. 180.
[2] Laws of 1836, chap. 82; 1839, chap. 310; 1840, chap. 190; 1842, chap. 135.
[3] Laws of 1846, chap. 143.

created by the appointment on the part of the governor of eight commissioners of public charities. These commissioners had very simple duties, to visit once a year the charitable and correctional institutions, to examine the conditions, and to make a report to the legislature. No authority whatever was granted to them to suggest improvements or to control the management of any institution. It was not long after this board was established until the need of some active control was recognized. The information collected by this board soon proved the necessity for some central authority, with power of control over the various institutions. It was not, however, until 1873[1] that the definite steps towards centralization of power in control and management were taken. From that time to the present it has been easy to follow the stages in centralization. We are now able to point out the steps that have been taken and the most important points reached in this gradual process. Attention is called to these stages which were reached in the following order:

1. Power to inspect all almshouses and all charitable and reformatory institutions.

2. Power to inspect all private institutions of charity receiving public assistance.

3. Power to inspect all children's agencies and to supervise the placing out of all children.

4. Power to inspect all medical dispensaries.

5. Power to pass upon the question of the incorporation of all institutions for charity desiring to incorporate. A license must be secured from the State Board of Charities before incorporation and before doing any business.

6. Power to pass upon all estimates of expenditures for all the state institutions.

7. Power to pass upon all plans for new buildings.

8. Power to establish rules for the admission and discharge of all inmates of all state institutions.

9. Power to maintain a bureau of state and alien poor, and to determine the actual residence of dependents and power to

[1] Laws of 1870, chap. 281; 1871, chap. 699, chap. 713; 1873, chap. 571, chap. 661.

transfer all dependents to their proper places of residence, whether in the United States or in Europe.

10. Power to control and supervise Indian dependents in New York.

11. Power to advise changes in the management of state institutions and to correct defects in the administration of affairs.

12. Power, with the aid of the comptroller, to fix the salaries of superintendents and other officers of state institutions.

### STATE COMMISSION IN LUNACY

In 1889[1] the State Commissioner in Lunacy was replaced by a Commission in Lunacy, consisting of three persons on salary. This act of the legislature provided that greater powers of inspection and greater powers to control and manage the various institutions should be given to the commission than belonged to the previous commissioner. New York was now making rapid progress towards complete centralization of control in this great department of charities, and in 1893 the policy of state support was inaugurated. The need of central supervision and control of moneys and all expenditures had become quite evident. The State Commission in Lunacy now has power to control not only current expenditures but also extensions and improvements. It is a board of control.

### STATE COMMISSION OF PRISONS

The same is true concerning the Commission of Prisons. It constitutes in reality a board of control. These commissions have not only power to supervise and control financial matters, but all other matters relating to the various institutions under their management.

The necessity for central control of the business and financial side of public institutions was early recognized in New York. A complete system of centralization on the business side was established in 1894,[2] when a comptroller was given power of

[1] Laws of 1889, chap. 283.

[2] Laws of 1894, chap. 654.

estimates for all state institutions. No money could be expended in any institution without the approval of the Bureau of Estimate in his office. Inspectors were sent out under salary from his office to make careful investigation at every institution in the state and to make detailed estimates of expenditures required for current expenses and for improvements.

This plan has recently been changed by another step towards centralization, viz., the creation of a fiscal supervisor. This fiscal supervisor is on salary and devotes his entire time to the business side of the state institutions. He is directed to do all the work of the inspectors formerly sent out from the comptroller's office; to make estimates of all expenditures for current expenses and for improvements; to superintend the purchasing of all supplies, and in many cases to do the purchasing himself, there being allowed to each institution about $25 a month to meet emergencies. It is quite generally recognized that such an officer is a necessity for the good business management of the state institutions. The only mistake made in New York is the failure to provide for proper supervision of this officer. It is expected that the next legislature will put this fiscal supervisor in connection with the State Board of Charities so that his reports shall first come to the board, and after inspection by the board be forwarded to the governor. They realize the danger of this office getting under political influence and are planning to make provision against that at an early date.

The State Board of Charities of New York is composed of twelve members, one from each judicial district of the state, two from New York city, and one from Brooklyn. The board meets on the average eight times a year, and it is now believed that if this board had supervisory powers over the fiscal agent the system in New York would be much more satisfactory than at present. While it is true that centralization has gone forward step by step so that the State Board of Charities has great administrative powers, at the same time it is universally recognized in that state that the local boards of trustees for the various charitable institutions perform valuable services. These local boards are composed of five to seven members, are appointed

by the governor for terms of four, six, and eight years, and are selected from among the best men and women of the state. In all institutions where women or girls are found, special emphasis is placed upon having a good representation of women on the boards. Many of the best citizens of New York have been secured for these local boards, some of whom have made special trips to Europe at their own expense in order to study the problems involved in the managament of the various institutions with which they were connected. It has been argued in Indiana and in other states that, should the business management of institutions be taken away from the local boards of trustees, there would not remain sufficient inducement to bring the trustees together to hold meetings and to devote time to the institutions. In New York as well as in Massachusetts the opposite has been found true. The local boards of trustees are very glad to get rid of financial responsibility, and they take greater interest on that account in the study of problems and in giving advice relating to the welfare of the inmates. Whether the process of centralization which has been going on during all these years in New York will ultimately lead to abolishing these local boards of trustees can not be determined at present.

With complete centralization in the lunacy and prison commissions, with complete centralization of the finances of other institutions in the fiscal supervisor, and with the large powers of inspection and supervision and administration in the State Board of Charities, it appears that New York has realized nearly all that is meant by a board of control in other states, and in addition to that is securing a great deal of voluntary service from prominent citizens connected with advisory boards.

## III

### OHIO, INDIANA, MICHIGAN, AND ILLINOIS

These four states are grouped together because they are the representative states of the Union in maintaining advisory state boards of charity, as opposed to state boards of control. These advisory boards have been the models for the country and have

been copied and adopted in many other states. The functions of these boards are learned from the following statements which are common to all of them:

"They shall investigate the whole system of public charities and correctional institutions of the state, examine into the condition and management thereof, especially of prisons, jails, infirmaries, public hospitals, and asylums; and the officers in charge of all such institutions shall furnish to the board, on their request, such information and statistics as they may require. And, to secure accuracy, uniformity, and completeness in such statistics, the board may prescribe such forms of report and registration as they may deem essential; and all plans for new jails and infirmaries shall, before the adoption of the same by the county authorities, be submitted to said board for suggestion and criticism. The board in its discretion may at any time make an investigation by the whole board, or by a committee of its members, of the management of any penal, reformatory, or charitable institution of the state; and said board or committee, in making any such investigation, shall have power to send for persons or papers, and to administer oaths and affirmations. And the report of such investigation, with the testimony, shall be made to the governor, and shall be submitted by him with his suggestion to the legislature."[1]

### ARGUMENTS IN FAVOR OF ADVISORY BOARDS

The principal arguments urged in these four states in favor of an advisory state board of charities are:

*First*—It is a clearing house of public opinion and of public discussion. It therefore does more to enlighten public sentiment than is possible for a state board of control. Since progress in charities and correction can only be made as public opinion is enlightened, the matter of publicity becomes a question of great importance.

*Second*—The people are kept in close sympathetic touch with the state institutions. These institutions belong to the people

[1] Acts of Indiana, February 28, 1899, sec. 2.

and, since their friends are in them, they have a right to know what conditions prevail.

*Third*—The members of the various local boards of trustees of state institutions are instructed by an advisory board of state charities and become familiar with the problems involved, so that these forty or fifty citizens are educated and become instructors in charity in all parts of the state.

*Fourth*—The general secretary of the advisory board and his office force, being relieved of financial details, devote their whole time to securing and coördinating knowledge for the benefit of the state institutions. In this way superintendents are greatly helped, and the inmates of all the institutions are benefited.

*Fifth*—The advisory board corrects many abuses in state institutions by its thorough investigations and by its incessant publication of information.

*Sixth*—It fosters individuality in the superintendents of state institutions.

*Seventh*—The advisory board secures economy in the expenditure of funds equal to the economy secured by a state board of control. This argument is insisted upon, especially in Indiana, where it is claimed that the showing is equal to the showing made by the board of control of Iowa. Mr. Amos W. Butler, the general secretary of the Advisory Board of State Charities of Indiana, recently made the following statements:

"Six years ago the annual cost of official outdoor relief and medical assistance in Indiana was $630,000. As a result of study of conditions the Board of State Charities recommended a change in the law. One law after another, bearing on the administration of outdoor relief, was successively passed to secure by progressive stages the desired results. After six years the amount given was reduced to $210,000 a year, and the testimony of all was that the poor were never so well cared for as they were under the new laws. Many were fearful that the poor asylum population would increase as a consequence. The result is that each year the number of inmates has been continually decreasing in the poor asylums of the state. The proportionate reduction of poor asylum inmates in ten years has been about seven hundred.

In other words, had we as many persons in the poor asylums in proportion to the population as ten years ago, we should be supporting seven hundred more than we are at a cost of $70,000. So the net results of the study of conditions and the enactment of laws to meet those conditions, together with proper supervision, have resulted in the annual reduction of about $500,000, just in this one phase of public charities. The reduction in pauperism and misery no one can measure."[1]

No other state claims so much on the side of economy. It is generally conceded that a board of control which gives close attention to financial details and which purchases supplies in large quantities, for all the state institutions, in an open market, saves the taxpayers of the state many thousands of dollars annually.

### SUCCESS OF ADVISORY BOARDS

In the four states mentioned, the advisory boards of state charities are among the oldest in the country, and have generally been recognized as the most successful. On this account they have served as models for other states. No one can doubt the good results which have followed their work. These good results can not be measured. The nation has been lifted to a higher plane by them, and the whole civilized world has been instructed and inspired to greater efforts in relieving distress and in bettering social conditions. The question arises How can we account for this marvelous success? It is accounted for on two grounds:

*First*—The advisory boards mark the first great step in the direction of centralization and supervision of state charities. Before they were created the many state institutions had local boards of trustees without supervision. Almost any kind of supervision would be better than none. The kind offered in these boards of state charities proved so successful that many leaders in charity and philanthropy have concluded that they are not susceptible of improvement. They fail to see that these boards have served their purpose and that the time has come for the

[1] Proceedings of Natl. Con. of Charities and Correction, 1902, p. 146.

state to assume absolute control and supervision under state boards of control.

*Second*—Another reason for the success of these advisory boards has been the personal influence of the great men of these states, who, as secretaries and members, have devoted years of time to the service. Some of these men have been recognized as the ablest statesmen of their respective states. The success of any system depends very much upon the men in charge.

### CHANGE OF SENTIMENT IN THESE STATES

There is now a growing popular demand for boards of control. In response to this demand Representative McDonald of Dayton, Ohio, introduced into the house of representatives of that state, in February, 1904, a bill to abolish all local boards and all financial officers of the state institutions, and to substitute a state board of control. The bill was defeated by a small majority, but the friends of the measure believe that such a bill will be passed by the next legislature.

The agitation in Illinois has been so strong in favor of a board of control that the legislature of 1903 was expected to pass the bill which was introduced to create such a board. The secretary of the Advisory State Board of Charities urged its passage. Other officials connected with the advisory board worked for it, but it failed to pass. The friends of this movement believe that a state board of control will be created by the next session of the Illinois legislature.

## IV

### STATE BOARD OF CONTROL OF WISCONSIN

Preceding the year 1871 all the state charitable and penal institutions of Winconsin were under separate boards of trustees with no supervisory authority over them.

In 1871, the Wisconsin State Board of Charities was created, with the usual powers and duties given to such an advisory board. This board investigated charitable and correctional institutions, made visits to all state and county charitable and penal institu-

tions, gave advice, made recommendations, and made reports to the governor. In these reports were found many complaints concerning unauthorized appropriations, doubling of weight of groceries and supplies, false classification of pay-rolls, unbusiness-like methods practiced by the officers, extravagant and wasteful expenditures, and political influences which retarded the development of all charitable and correctional work. It was also found during all these years that the state institutions were constantly lobbying against each other in securing appropriations. At the same time this board was powerless to make the necessary corrections.

These things led the legislature of Winconsin, after ten years of such experience, to create an additional board known as the State Board of Supervision, in the year 1881. To this board was given authority to control reformatory, charitable, and penal institutions beyond the authorities possessed by the State Board of Charities. This was a step in the right direction. It was soon found, however, that the two boards clashed with each other on questions of administration and supervision. The two boards continued in existence for ten years until the year 1891 when, because of jealousies and conflicts between them on questions of jurisdiction, it was decided to abolish both of them. This was done by the legislature of 1891 and the State Board of Control was established. The Board of Control was a natural evolution. It consists of five members, and was the outcome of the centralizing tendencies which were first manifested in creating the State Board of Supervision in 1881. During all the years following 1881 there was a gradual manifestation of a tendency towards centralization until its complete realization in a State Board of Control which puts Wisconsin in an advanced position among the states in the work of administration of charities and correction.

Many very satisfactory results have followed the establishment of this board. Under the old method, it was the custom to disregard in great measure the fitness of superintendents and other officers of state institutions, and to select men through political influence. It is the common testimony of the people of

Wisconsin that the Board of Control has very largely succeeded in eliminating all political considerations in appointments. It is also the common testimony that the old system of leaving business management and the purchase of supplies to the local authorities of each institution was unsatisfactory. Each institution under that system became the prey of the business men and supply houses of the locality and of the political party in power. Their abuses and unbusiness-like methods could not be corrected. Very little, if any, competition was admitted in the purchase of supplies. The Board of Control did not succeed in completely overcoming these conditions until 1898, when they assumed entire responsibility for the purchase of all staple articles, and applied the same business principles that are followed in a private business. The contract system was introduced in purchasing large quantities of goods. They found that Chicago firms were the lowest bidders. Their first biennial report showed a saving to the state in the purchase of supplies of $121,183.15. The common judgment in Wisconsin is that in the management of county and city jails, poorhouses, and in the management of all charitable and penal institutions of the state, the Board of Control has secured far better results than were possible under the old system. There is no disposition in that state to go back to the old methods.

## V

### IOWA AND MINNESOTA BOARDS OF CONTROL

These states are considered together because both of them have progressive state boards of control which are after the same model. Iowa was in advance, creating a State Board of Control, March, 1898. The Minnesota State Board of Control was established in April, 1901, with slight modifications of the Iowa law. In the study of these boards, which are now regarded as representative boards of control, it is important to have a clear conception of a board of control in distinction from an advisory board of state charities. The following brief summary of the law creating these boards of control shows the real functions of such a board.

The board consists of three members appointed by the governor and affirmed by a two-thirds vote of the senate, to serve for six years, with a salary for each of $3,000 per annum.

Power is given to the board to investigate the management and financial conditions; to manage, control, and govern all state institutions; also to pass upon all questions relating to prison administration, to pass upon buildings, improvements, and upon all questions relating to the insane and other wards of the state.

The board is enjoined to prepare annual statements showing cost of operating each institution for the preceding year; to make biennial reports to the governor and legislature; to visit all institutions at least once in six months, and to visit all hospitals at least once a month; to meet all superintendents of institutions quarterly in conference; to gather statistics; to publish a bulletin; to compel the providing of fire protection and fire-escapes; to compel all employees handling money or property of the state to give bonds; to require inventories of all the state's movable property, and quarterly inventories of all supplies and stores; to fix annually the salaries of all officers and employees of institutions.

The board is required to furnish a complete record to be kept at each institution, where all complaints, made by inmates, employees, and others must be entered.

The board is directed to devise and to apply to all institutions the best system of bookkeeping known, and to prepare the necessary books and blanks therefor. Monthly trial balances are required to be made and sent to each institution. There is allowed to the head of institutions a special contingency fund, not exceeding $250, for emergencies.

The board has full charge of the purchasing of all supplies. Estimates are made by each institution superintendent in triplicate once a year for coal, flour, and canned goods, and every three months for supplies of all other articles. These estimates are sent to the office of the board. They are then passed upon by the board, and reduced or added to as to the amount, or changed as to estimated prices. When approved, the estimate is returned to the institution and one copy filed in the office of the

board. When the estimates are all in the hands of the board quarterly, a schedule is made up for each institution of all articles estimated for. These schedules are sent, with printed specifications, to all bidders and wholesalers for such goods in the state, and to many in Chicago, St. Louis, and other cities. When the bids are received they are opened, and each firm's bid upon every item scheduled, and the total of each bid footed. Samples are required for canned goods, salt, and smoked meats, groceries, clothing, dry goods and findings, cloth, stockings, and many other articles. These samples are arranged convenient for inspection. The quarterly meeting of the superintendents is held as soon as these schedules and samples are ready, and the superintendents inspect the samples and bids, and leave a written memorandum with the board indicating their choice. Awards are then made to the successful bidders. Should the successful bidder furnish an inferior article, the superintendent at the institution is directed to return the goods.

At the end of each month the pay-roll and all vouchers are certified to the board, and when approved it is so indicated by the board, and the secretary makes triplicate certificates, one to the state auditor, one to the state treasurer, and one to be kept in the office of the board. The full amount of the pay-roll is certified to be paid the superintendent, who disburses it to the several employees. On receipt of the certificates and warrants from the state auditor, the state auditor mails a check to each of the other certified persons.

The storekeeper is required to give bonds at each institution. Quarterly balances and invoices of goods on hand are taken. Occasional invoices of all institution stocks are also taken by an expert appointed by the Board of Control, without previous notice to the storekeeper. No goods are disbursed except upon requisitions signed by the chief executive officer, and these requisitions are in triplicate, one copy being retained by the storekeeper, one by the bookkeeper, and the other returned to the Board of Control. Duplicate storekeeper's books are kept in the office of the Board of Control.

EXPERIENCES OF IOWA BOARD OF CONTROL

was fortunate in securing excellent men on the Board
ol at the beginning. These men are well-known through-
commonwealth, and have the confidence of the people.
same time they are men of great business ability, broad-
sympathetic. The state treasurer's report at the end
first year showed that this Board of Control saved the
ers of Iowa $175,000. In addition to this, the inmates,
l as the officers of the various state institutions, agree in
estimony that since the Board of Control took charge they
better food, better clothing, and better care. There can be
ubt that this testimony is true.

e superintendents of the institutions are pleased with the
system and testify that the needs of the various institutions
quickly met. Three men upon this Iowa Board of Control
in session every working day of the year from 8:00 o'clock
until 3:00 P.M., and have long distance telephone connec-
with every state institution.

great improvement has taken place, especially in the care of
insane of the state. When the State Board of Control came
o authority, one of the members of the board, after visiting
ferent parts of the state, among other things reported the
llowing: "At one county house, I found a poor dement who
as tied to a tree in summer and to a bedpost in winter because
ere was no one to take care of him. Another patient I found
onfined in a cage, and had been kept there for years because,
when given his freedom, he persisted in running away." Both
of these patients are now in state hospitals receiving proper care.

Another part of the experience in Iowa is that members of the board have no difficulty in securing needed appropriations for the various state institutions. Members of the board never lobby, never solicit the support of a single member of the legislature for an appropriation. They make reports after a thorough investigation as to what is needed at the state institutions, and upon careful investigation the legislatures have found the reports and recommendations to be just and right.

EXPERIENCES OF MINNESOTA BOARD OF CONTROL

Minnesota had the advantages of an advisory board of state charities for nineteen years from 1883, and during most of this period Dr. H. H. Hart served as the efficient secretary. Under his leadership thirty important recommendations were made by the board to the Minnesota legislature, twenty of which were adopted and became law. The people of that state tested the value of an advisory board under the most favorable circumstances, having the leadership of a secretary of extraordinary ability. It was generally recognized that the board was a great advance over the old system of no state supervision, but another step in advance of this was required. In 1901 popular sentiment demanded a State Board of Control, which was created by the legislature of that year. This Board of Control took hold of the business problems connected with the state institutions and found them in very unsatisfactory shape.

INVENTORIES

As directed by law, they took inventories of all the state's property, and found that in the past these inventories had existed only in name. While attempts at inventories had in some instances been made, they were so incomplete and inexact and so little use was made of them that it can truthfully be said they were of no practical value to the state. At the close of their first year's experience, the Board of Control reported: "There were plenty of accounts showing that millions of dollars' worth of goods had been received, but what had become of them was largely left to conjecture. The lack of inventories, the unbusiness-like manner in which the accounts at many of the institutions were kept and the business transacted, opened ways for systematic and extensive frauds which, had they been utilized, would have resulted in great loss to the state. On account of the manner in which the business was transacted and the accounts kept, it is impossible to determine whether this has been the case. It is but fair to say that the superintendents of the several institutions referred to were in no way responsible for the conditions mentioned.

Under the old many-board system the stewards were absolute monarchs in their departments. They purchased when and where they pleased, from whom they pleased, in what quantities they pleased, and paid what they pleased, and the superintendents had as little authority over them as the merchants from whom they purchased. The steward's department was a separate and distinct branch of the institution, from which they received their supplies, and to whom they were expected to ask no questions."[1]

## DISCIPLINE IN STATE INSTITUTIONS

An important result of the new system in Minnesota has been the securing of better discipline among employees in every state institution. The law provides that there shall be but one head to each institution, and that head is the superintendent. Under the Board of Control it has been found that now the superintendent of each institution is able to maintain discipline and secure proper and effective service as never before. He is in a position to accomplish this because he makes all his appointments from assistant superintendent down, and may dismiss for good cause any employee under him, although he is required to keep a record of such dismissal and the cause therefor. Each superintendent is held responsible to the Board of Control for every act of his assistants and employees. Not only the superintendents, but the employees themselves, have borne testimony that the new plan is a great improvement over the old.

## FAVORITISM

Under the Board of Control there is no favoritism for relatives or for political friends. The following regulations have been strictly adhered to with splendid results:

"1. No relative of any of its members, either by blood or by marriage, shall be appointed to any position under said board, and no member of said board shall exert any influence by solici-

[1] First Biennial Report of Board of Control of Minnesota, July 1913, p. 4

tation, or otherwise, upon the managing officer of any institution in the selection of an employee."[1]

"2. No person will be removed by this board except for cause."

Superintendents have been continued in office on the grounds of fitness regardless of political affiliations. When the Board of Control was first appointed, politicians and office seekers besieged the board for appointment, but to no avail. In its first annual report the board stated that, "a decree of absolute divorce between politics and the state institutions has been entered by the people in the establishment of a Board of Control of state institutions, and the enactment of a law forbidding the exercise of political influence directly or indirectly in their management."[2]

No solicitation of funds for political purposes is allowed in any institution; and punishment is provided for any such solicitation.

### FOOD, CLOTHING, AND CARE

There was much anxiety at first on the part of some concerning the inmates of the state institutions under the new system. The state had expended millions of dollars in the creation and maintenance of its institutions, and was solicitous for their usefulness to all the dependent wards of the state. Within less than one year's time all anxiety was allayed, and the general testimony of the people of Minnesota is that never in the history of the state have the welfare and happiness of the inmates of the state institutions been given so much attention as is given under the management of the Board of Control. Formerly many of the institutions were served with bread made from Red Dog flour. Now only the best grades of straight flour (samples being required and submitted to scientific tests, as well as to the practical test of bread-making, to determine their quality) are purchased. Every superintendent is now required to submit to the office of the Board of Control, on the first of each week, a bill of fare for every meal to be served the inmates of his institution during that week. No distinction is now made between quality or grade of

[1] First Biennial Report State Board of Control of Minnesota, p. 5.
[2] *Ibid.*, p. 7.

supplies purchased for officers, employees, or inmates of state institutions, all being fed from the same general store.

### INDUSTRIAL WORK

The Board of Control has inaugurated the manufacture of boots and shoes at the State Reformatory, which are used to supply other state institutions. It is worthy of mention also that all the soap, except toilet soap, used in the state institutions of Minnesota is now manufactured at the Rochester Hospital. All brooms used in all state institutions are made by the blind of Faribault. This industrial work has been introduced by the Board of Control because it is believed that inmates of institutions are in special need of two things: First, good food, well served; and second, occupation. These greatly assist in securing best results in their treatment.

### PURCHASE OF GOODS

The Board of Control introduced a new system of securing bids in the open market, and of purchasing in large quantities for all the state institutions. The propositions for goods as well as the samples are open to inspection by the superintendents, who take an active part in the awarding of contracts, each selecting such goods as in his judgment are best constituted to the needs of his institution, quality and prices being taken into consideration. If lower propositions are accompanied by samples of an inferior quality or goods not suitable for the service intended, they are rejected and those of a higher price and quality taken instead. The judgment of the superintendents is found of great value in the selection of goods, especially clothing, bedding, etc. It has been found as a matter of experience that this course insures the purchase of goods that are not only satisfactory to the superintendents, but most economical in point of service, prices being a secondary consideration in every case. Few realize the amount of labor involved in receiving and tabulating these bids. There are upwards of five hundred of them, and it takes the entire office of the Board of Control about ten days to tabulate

them. The proposals are not published, and this keeps the bidders guessing how close they must figure to get the business. Success in purchasing goods is largely attributable to this system, which has saved the state many thousands of dollars. All these bids are subject to inspection by the superintendents, and also by the governor of the state, the public examiner, and committees from either branch of the legislature, or by any court of record.

The net savings for the first year under the Board of Control, ending July 31, 1902, over the expenditures for the previous year were $105,615.85, and to this should be added the amount saved by readjustment of insurance, making net savings $147,369.90 for the year.

## VI

### CLASSIFICATION OF STATE BOARDS

Massachusetts and New York belong in a class by themselves, having the functions and advantages of both boards. The following states have central state boards of control: Wisconsin, Rhode Island, Iowa, Minnesota, Kansas, and Washington.

The following states have advisory state boards of charities and correction: Ohio, Indiana, Michigan, Illinois, Pennsylvania, Connecticut, Colorado, California, Arizona, District of Columbia, Georgia, Missouri, Nebraska, New Hampshire, New Jersey, North Carolina, Maryland, South Dakota, Tennessee, Wyoming, and Montana.

## VII

### CONSIDERATIONS WHICH FAVOR A STATE BOARD OF CONTROL

From the preceding study of the representative states of the Union which have tried and tested advisory boards and boards of control several advantages in favor of a board of control have appeared:

*First*—A state board of control greatly decreases the cost of maintenance of all the state institutions and saves the taxpayers from $100,000 to $150,000 annually in each state where it has been fairly tried.

*Second*—A state board of control secures greater accuracy in accounts and facilitates the transaction of business by furnishing uniform blanks and a uniform system of bookkeeping for each state institution, and thus secures greater efficiency of administration.

*Third*—A state board of control eliminates local controversy in the communities where the state institutions are located, over the question of dividing the state's bounty in purchasing supplies, etc., and also prevents legislative combinations for that purpose.

*Fourth*—A state board of control provides better food, better clothing, and better care for the inmates of all state institutions, and thus preserves and extends the purposes for which the institutions were established.

*Fifth*—A state board of control secures better discipline among the employees and inmates of every state institution by means of the special powers conferred upon each superintendent to select his own assistants and employees and to discharge them for cause. It secures in this way the merit system with employees.

*Sixth*—A state board of control relieves the superintendents of the state institutions from the burdens of financial details, and enables them to study, as never before, the real problems involved in their work, and to preserve and extend the educational and reformatory purposes for which the institutions were founded.

*Seventh*—A board of control, constituted upon the plan of Iowa and Minnesota, practically eliminates politics from the management of state institutions. Civil service principles are adhered to from the beginning.

*Eighth*—A state board of control is an expression of the best thought of the age in centralizing large business enterprises. It is in harmony with the drift of events and meets the demands of the times. The state institutions have grown to such large proportions, involving the expenditure of such large sums of money and involving such intricate and complicated problems affecting the interests of all citizens, that popular judgment favors a central state board of control.

*Ninth*—A state board of control practically insures equitable appropriations to the different state institutions, and prevents the

constant lobbying of institutions against each other. It is well known that under the old system of advisory boards superintendents of state institutions and local trustees spent many days lobbying with each legislature for appropriations. Those who are most skilful in such business secure large appropriations, often more than actually needed, while other institutions are left to suffer because of inadequate appropriations. No difficulties of this sort arise under a state board of control.

*Tenth*—A state board of control corrects abuses, makes needed changes, and enforces recommendations. An advisory board is powerless to enforce recommendations. It can investigate, advise, and report. The testimony in Wisconsin, Iowa, and Minnesota is that since boards of control were created no complaints against institution management have arisen which have made formal investigation necessary. The moral effects of the existence of these boards are everywhere recognized.

## VIII

### OBJECTIONS TO STATE BOARDS OF CONTROL CONSIDERED

*First*—It is urged that a state board of control is in great danger of getting into politics. This objection is based upon the fact that such large powers are placed in the hands of a few men. This objection has arisen because the experiences of a board of control in Kansas have been exceedingly unsatisfactory, and the board has been under the manipulation of politicians most of the time since it came into existence. Two explanations are found for this condition of things in Kansas. In the first place, the law creating the board was an unsatisfactory law and failed to provide against such dangers; and in the second place, men secured membership on this board who were totally unfitted for the positions. The experiences, however, in Wisconsin since 1898 and the experiences in Iowa and Minnesota have been just the opposite. Especially is this true in Iowa and Minnesota where the board of control law is so constructed as to divorce politics from the board of control, and the experiences in those states since the boards were created have demonstrated that this is true. What

has been accomplished in these states can be accomplished in other states.

*Second*—It is urged that a state board of control crushes out the individuality of superintendents. We have already seen that in Iowa and Minnesota superintendents exercise greater powers than are given under advisory state boards of charity. These superintendents select their own assistants and employees and have power to discharge them for cause. We have also seen that the superintendents, being relieved of the burdens of financial details by the board of control, give their time to the study of the problems involved in their work and to preserving and extending the humane, educational, and reformatory purposes for which the institutions were established. As a matter of actual experience it has been found that the individuality and efficiency of superintendents have been greatly increased under this system.

*Third*—It is urged that a state board of control does not and can not study the problems of charity and correction as is done by an advisory board. Ohio, Indiana, and other state boards of charity are mentioned as illustrations. It is claimed that three men on a state board of control, burdened with financial details, can not become familiar with the conditions of inmates of the many state institutions, and that, in the very nature of the case, forty or fifty members of local boards of trustees, together with an advisory board of state charities, can give more time to the study of problems of education and care and treatment of the wards of the state. Theoretically this is true, but as a matter of fact it has been found that the majority of the local trustees of institutions devote very little time to the study of the problems involved in the administration of affairs connected with the institutions. There have been some notable exceptions, especially in Massachusetts, New York, Ohio, and Indiana. These states have also furnished some of the best men of the nation for service on state boards of charity. It has been found impossible to secure the services of such men in the great majority of states where state boards of charities have been created. As a part of the actual experience of state boards of control it has appeared that their members devote all their time to the problems involved in

the management of the state institutions. Their time is not wholly given to financial matters, but in cooperation with the superintendents they come into close sympathetic touch with the inmates and reach intelligent solution of the problems relating to their good.

*Fourth*—It is urged that a state board of control can not keep in close touch with the people and can not accomplish as much as an advisory board in the enlightenment of public opinion. This objection is perhaps as strong as any. Boards of control have not fully solved this problem of securing sufficient publicity as a means to the enlightenment of public opinion. No serious difficulties, however, have arisen on this account, and we have reason to believe that provision will be made in the future to meet this objection.

*Fifth*—It is urged that a state board of control will give little attention to what is being accomplished in other states and will take little interest in the discussions of the National Conferences of Charities and Correction. We do not understand on what grounds this objection is based. Members of state boards of control visit other states and seem to take as much interest in public discussions of charities and corrections as do members on the advisory boards.

*Sixth*—It is urged that a state board of control can not impartially investigate abuses at state institutions, because in doing so it would be investigating itself. In Wisconsin, Iowa, and Minnesota, since the state boards of control were established, no needs have arisen to make a formal investigation of alleged abuses. This is accounted for from the fact that the board is given authority to correct all abuses. This being understood, it has served the purpose of preventing their occurrence. Power to make all needed changes and to enforce their recommendations has had the effect of securing better administration than was possible under an advisory board.

## IX

### GROUNDS UPON WHICH STATE CONTROL AND SUPERVISION REST

It grows out of the nature of the state itself, which is a living organism. As a living, growing body the state has many members with many functions. As illustrated by M. Fouillee: "In the highly organized machines used in the manufacture of cotton or woolen stuffs, when a single thread breaks, the loom stops of its own motion, as if the machine were notified of the accident which has happened to one of its parts, and could not continue its work until this is repaired. This is a sample of the solidarity which will more and more hold sway over human society. In this web of social interests, wherein all individual destinies are interwoven, not a thread, not an individual should be injured without the general mechanism being warned of the accident affected by it, and obliged to repair the harm done as far as possible."[1] If one member suffers all members suffer. Just as the brain is the supreme center for the direction of the members of the body, so the state constitutes the center for the control and supervision of charities and correction. These problems are of vital importance to the whole community and are so complex and so interwoven with the life of the people that state control is a necessity.

## X

### EVOLUTION OF STATE CONTROL AND SUPERVISION

For many years there has been a steady drift toward state control and supervision. Not long ago most of the insane patients of this country were cared for in almshouses. In the process of evolution private charity, going in advance of the state, took many of the insane out of almshouses and put them into private hospitals which had been constructed for that purpose. These hospitals were built by the generous gifts of private individuals

[1] La science sociale contemporaine, p. 211.

in the East and as far West as Illinois. The time came for the state to take up this charity, and it may now properly be said that this form of private charity belongs to the past. No further appeals are made for private donations for the care of the insane. Private aid must now be given in the way of information, suggestion, and advice to the state in the care of these unfortunates. State hospitals possess such an equipment for their treatment and care as would never have been supplied by means of private charity. The burden of expense is borne proportionately by all taxpayers. The time has come in the process of evolution when the state has assumed an absolute responsibility, not shared with individuals, in the care and management of these unfortunates.

Private charity took the lead in the care of the feeble-minded and epileptics, but the time came when the state assumed the care of these unfortunates the same as with the insane.

Centralization has gone forward until the blind and deaf mutes are cared for under state supervision. The public, however, still remains in sympathetic touch with these classes, and private individuals with charitable impulses will always have a wide field open before them for exploration, for experiment, and for the accumulation of information. They can do this by aiding the state to adopt the best methods in their care and treatment. The state, however, will remain the supreme head with absolute power of control and supervision.

We observe that in the process of evolution of state control and supervision other lines of charitable effort have come partly under state control. This is true in the care of homeless and dependent children, and also in the care of cripples. It is also true in hospital treatment of tuberculosis and other diseases, both mental and physical. From the drift of events in this direction we are led to believe the time will come when these will be as perfectly under state control and supervision as is the care of the classes above mentioned.

## XI

### RIGHT OF THE STATE TO CONTROL AND SUPERVISE CHARITIES AND CORRECTIONS

New wants are springing up at every step of progress. Human desires and activities are ever increasing. New conditions arise and new forms of aid and relief and of correction are demanded. It is important to determine whether the state has the right to control and supervise them. Bluntschli says: "It is acknowledged now that law and its administrators do not merely exercise rule over individuals, but render very essential and important services to them. A large number of useful and beneficent institutions owe their origin to this view."[1] He further explains that, "The end of the state is the development of the national capacities, the perfecting of the national life, and finally its completion."[1]

McKechnie says, "The good of humanity is the end of the state."[2] Concerning the sphere of the state, he says, "As everything within the territory of a state is subject to its control, it follows that its proper sphere is coextensive with the range of its dominions."[2] "If it is the business of the state to preserve itself from dissolution, the supervision of the morals and intelligence of its people lies, undoubtedly, within its normal sphere. There is no part of the life of man that can claim to lie outside of its sphere."[2] In harmony with these views Dr. C. R. Henderson of Chicago is correct in saying, "The state alone is the organ of all members of society, and it alone has the acknowledged right to supervise and govern all institutions."[3] This right carries with it moral obligation.

[1] The Theory of the State, pp. 307, 320–21.
[2] The State and the Individual, pp. 83, 92, 96.
[3] Dependents, Defectives, and Delinquents, p. 62.

## XII

### MORAL OBLIGATION OF THE STATE TO CONTROL AND SUPERVISE CHARITIES

Some have argued that the only grounds upon which the state engages in charities and correction is self-protection. It is generally accepted that this is true as far as the treatment of the criminal is concerned. Those who advocate this view affirm that self-protection is the only reason for state action in charities and correction and that no other element can possibly enter for consideration. This seems to be a narrow and selfish view. Even in the punishment of criminals it is now recognized that self-protection is not the only purpose. Modern philanthropists are generally agreed that the reformation of the prisoner is the chief object. To claim that self-protection is the only object in punishment of crime is repellant to the better feelings and judgments consciously existing in our modern civilization.

It has also been argued that the state cares for the insane, feeble-minded, epileptics, cases of tuberculosis and of other forms of sickness, wholly on the grounds of self-protection. There is an element of truth in this, and it may be said to be a part of the truth. But in relieving distress, in ministering to those who are sick either in body or mind, and in guiding the steps of the erring to good citizenship modern states are conscious of a higher motive than mere self-protection. The state is conscious of a high moral obligation, of duty. It is the same kind of moral obligation as that which is recognized in the matter of education. Not many years ago the work of education was conducted by private enterprise; now the state manages our splendid public school system.

In England many private schools were closed by the public authorities and the property caused to revert to the government, because of the inefficiency and harmful influences of such schools. It was right to close them. Upon the same grounds the government of France has for more than two years past closed on the average one private school per week.

The order of studies pursued and methods of training are far from being perfect, but who would advocate the abolishment of our public schools? The state is morally bound to her citizens to maintain and improve the educational system. If we recognize this principle in the matter of education we must recognize it also in dealing with law-breakers and with orphan children, and in all departments of charity and correction. How could progress be made towards the high ideals of the people without the state's recognition of moral obligation to each citizen?

This moral obligation is often grounded in the claims of individual citizens upon the state for services rendered. For example, a man served his country in the Civil War. Afterwards he was industrious and self-supporting. He filled important offices in the state, and in many ways served the community in which he lived for many years, when misfortune overtook him. He lost his home and all means of support, became a cripple for life, and was found in absolute dependence for food and care. Who would say the state helps him simply on the grounds of self-protection? It might as well be said there is no public conscience, no public sense of right and wrong.

Others have stood ready to perform such services but were never called upon. The state is under the same obligations to these as to him. Thirty years ago President M. B. Anderson of Rochester University stated, "A nation is a moral organism which owes certain duties to its members."[1] Dr. C. R. Henderson wrote, "Much charity flows from a race instinct of sympathy." "This instinctive sympathy is the natural basis of the ethical demand for charity—part of our moral view of the world." "It is a social duty to protect every citizen, without regard to character, from extreme misery and death."[2] The state is morally bound to aid every citizen in times of need. It is a matter of simple justice. This principle is not yet generally accepted, but is gaining ground. The time will come when, in the light of this truth, popular notions will be dispelled and no thought or feeling of humiliation will come to those who receive such charity.

[1] N. C. C., 1876.

[2] Dependents, Defectives, and Delinquents. 2d edition, pp. 41, 44, 45.

## XIII

### LIMITS TO STATE CONTROL AND SUPERVISION OF CHARITIES AND CORRECTION

There are, however, limits to the extension of the control of the state over these matters.

### FINANCIAL LIMITS

Even on the financial side the state can not make sufficient appropriations to meet the necessities. Taxpayers would not submit to it. Public opinion would not favor it. Private charities must bear the burdens in many lines of effort. This has always been true in the past and will be true in all future time. It is just as it should be. The state is always behind. Private charities go in advance, explore new fields, make experiments, expend large sums of money, demonstrate and prove the value of well worked out systems; then the state takes control and supervision. Private workers have other fields to explore, and these fields are boundless.

### LIMITS ARISING FROM LACK OF SYMPATHY

Many have believed that the state is cold and unsympathetic and that in the nature of the case it must forever leave certain kinds of relief work to private charities. Mr. Earnest P. Bicknell of Chicago writes: "I believe it is the universal opinion of those who have given the subject thought that the administration of official or public relief in the homes of the poor fails to provide those sympathetic and stimulating influences necessary to neutralize the disintegrating effects of the relief itself. The gift must have in it something of the personality and sympathy of the giver. It must mean something of sacrifice on the part of the giver. In the very nature of the situation these finer requirements and accompaniments of the giving can not attach to the gift from public funds by a public official."[1] The conclusion is that all relief work for the poor in their homes must be done by

[1] Special Paper at Bureau of Charities, Chicago, November, 1903, p. 5.

private charity. This involves the assumption that the state can never learn to do such work as it ought to be done. Are we warranted in drawing such a conclusion? It is true that blunderings and political corruption have characterized much of the public relief of the poor in their homes in the past, but the improved methods of late justify the belief in still greater improvements. Give the state time to be free from the "spoils system," and time for civil service principles to dominate, and then, I believe, the state will do the relief work in families much better than the average official representatives of relief and aid societies. In spite of all the talk about "personal touch and personal sympathy," my observations have led me to believe that in the work of private societies there is a good deal of officialism and lack of personal sympathy and self-sacrifice. Even the charity organization societies have been driven to practice indirections. There has been a steady tendency towards relief and aid work on their part. In most cities this has been a necessity, and all sorts of schemes of indirections have been tried. The visitor goes to the home of poverty and distress as a friend, speaks words of sympathy, encouragement, and advice, and then under some kind of a cover sends food, coal, etc., to relieve the distress. The money used in the case was contributed by a business man who had no time to visit any poor family. His money, however, had gone into the general relief fund of the society, and in very few cases, relatively, is any specific report made to the giver. He does not care for it. The fact is that most of relief is given officially. There is very little of the personal touch anywhere of the giver with the poor in distress, and to make up for this our charity organization societies are doing the best they can, and are to be greatly commended. No one doubts but that better methods will be adopted next year than were in use in the past year. Every society is learning by experience. The state is learning also, and it is expected that new systems and methods of state relief work will be evolved in the future which will enable the state to utilize the element of self-sacrifice and personal sympathy far better than they are utilized by private societies to-day. This will insure thoroughness and efficiency.

LIMITS ARISING FROM PREJUDICES AGAINST STATE CONTROL AND SUPERVISION

Many private charities are controlled by religious societies and they strenuously oppose state interference. Even in cases where the state appropriates funds to the private charities, this opposition to state supervision has manifested itself. In New York City the appropriation for the aid of the poor cared for in private institutions in 1900 was $3,079,259. Outside of the city, for the rest of New York, the appropriation of public funds to private charities amounted to $3,750,000, of which over $2,000,000 was for the support of dependent children. The legislature of Pennsylvania for the same year appropriated $1,200,000 to semi-state institutions and about $3,500,000 to private institutions. Until recently these subsidized institutions have fought state supervision at every step of progress. Now, state supervision is generally recognized to be right and is demanded. The leaders admit that the state has the right to "look after the expenditure of state funds according to contract," but affirm that "the state has no right to go behind the boards." It is evident that much of this opposition has grown out of religious prejudices. The state has by this been hindered and limited in its operations, but is gradually gaining control.

Private societies which receive no state aid are still more pronounced in their opposition to state supervision. This is especially true of societies for homeless children. A fundamental principle with most of these societies is that a Christian home shall be found for every homeless child. They urge that the state can not for one moment take into account the question of a Christian home for a child. Is this not an *a priori* assumption? What shall be the definition of a Christian home? Membership in a particular church does not always insure that the home is a Christian home. We believe the state can and will secure the services of the highest types of Christian men and women to place and supervise homeless children. This has been done, as is well known, in Michigan, Minnesota, and Canada. It can be done in all the states. The drift of events is in the direction of

state control and supervision of both the institutional care of children and of the placing-out system. Does anyone believe that political "bossism" and the "spoils system" in the management of charities will continue forever? Students of modern society can see the signs and promises of better things in social and political evolution. The way has been prepared by private charity for state control. Placing-out agencies have experimented until well-defined principles and methods have been established. It appears that the time has come when the state could assume full control and supervision. The best experts of the country, men and women with special training and adaptability, are available. These men and women can be depended upon, as officers of the state, to investigate homes thoroughly, to take into account questions of kind treatment for the child, moral and religious environment, educational and social advantages, and financial conditions. They will be able, therefore, to select the very best homes for these wards of the state. This will give unity, harmony, economy, and efficiency in the work.

At present there is much unnecessary duplication, friction, waste of time, waste of energy, and waste of money. In nearly every community a half-dozen child-saving societies are soliciting funds and operating often to the detriment of each other, and with great loss of efficiency.

## XIV

### IMPERATIVENESS OF STATE CONTROL AND SUPERVISION

Immediate state control is demanded in order to save the lives of thousands of infants and small children who are to-day in the hands of ignorant and sentimental nurses and caretakers, where they suffer from poor ventilation, unsuitable food, and bad sanitary conditions. These little ones are left to languish and die. Some of these workers, in their enthusiasm, are over-religious and self-deceived believing they are working for God and for the good of humanity. Others see in it the opportunity of getting a living. The generous public is imposed upon while the lives of bright and promising children are blighted.

State control is required to correct such abuses. Massachusetts and New York require that every children's agency shall be licensed by state authority before transacting any business. The Colorado legislature in 1901 established a law that all private eleemosynary societies and corporations should not only secure licenses, but should have them renewed annually. The Iowa State Board of Control is instructed by law not only to inspect all private institutions for children, but to prescribe certain rules for their conduct.

Indiana, Illinois, Ohio, and Minnesota have made provision for state inspection and supervision of private institutions and societies for children. Other states see the necessity for this and will soon have similar laws. These laws, enacted in the spirit of the centralizing movement, relate not only to the institutional care of dependent children, but also to the entire placing-out system.

It is not expected that all institutional care and placing-out of children will come under absolute state control in the immediate future, but that is the ultimate goal, and social forces are moving towards that inevitable result.

Abuses are repeatedly found in county poorhouses, in county jails, and in other departments of charities and corrections. State control and supervision are imperatively demanded to correct these abuses.

ANALYSIS OF CONTENTS

I. State Board of Charity of Massachusetts, 4; State Board of Insanity, 9; State Board of Prison Commissioners, 10.

II. State Board of Charities of New York, 11; State Commission in Lunacy, 13; State Commission of Prisons, 13.

III. Ohio, Indiana, Michigan, and Illinois Advisory State Boards of Charity, 15; Arguments in Favor of Advisory Boards, 16; Success of Advisory Boards, 18; Change of Sentiment in these States, 19.

IV. State Board of Control of Wisconsin, 19.
V. Iowa and Minnesota Boards of Control, 21; Experiences of Iowa Board of Control, 24; Experiences of Minnesota Board of Control, 25; Inventories, 25; Discipline in State Institutions, 26; Favoritism, 26; Food, Clothing, and Care, 27; Industrial Work, 28; Purchase of Goods, 28.
VI. Classification of State Boards, 29.
VII. Considerations which Favor a State Board of Control, 29.
VIII. Objections to State Boards of Control Considered, 31.
IX. Grounds upon which State Control and Supervision Rest, 34.
X. Evolution of State Control and Supervision, 34.
XI. Right of the State to Control and Supervise Charities and Corrections, 36.
XII. Moral Obligation of the State to Control and Supervise Charities and Corrections, 37.
XIII. Limits to State Control and Supervision of Charities and Corrections, 39; Financial Limits, 39; Limits Arising from Lack of Sympathy, 39; Limits Arising from Prejudices Against Control and Supervision, 41.
XIV. Imperativeness of State Control and Supervision, 42.

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## CONTENTS

I STUDIES ON HUMAN PARASITES IN NORTH AMERICA—I. *Filaria loa*
*Henry B Ward* . . . . . 271

II THE NEWLY-DISCOVERED SHAKESPEARE DOCUMENTS
*Charles William Wallace* . . . . 347

III STATE CONTROL AND SUPERVISION OF CHARITIES AND CORRECTIONS
*Anderson William Clark* . . . . 357

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